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Title

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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ABSTRACT

Objective

Maternal and child health (MCH) care may provide an entry point for HIV services in high HIV-prevalence settings. Our objective was to assess integration of HIV with MCH services in public sector facilities in Swaziland.

Design

In 2009, 2010 and 2012, client flow assessments were conducted over five days in the MCH units of eight government facilities, purposively selected as intervention or comparison sites.

Participants

8263 MCH visits with female clients were tracked: 3261 in 2009; 2086 in 2010; and 2916 in 2012.

Intervention

Activities and resources to strengthen integration of HIV services into post-natal care, 2009 - 2010.

Main outcome measures

(1) The proportion of all visits in which an HIV/STI testing, counselling or treatment was received together with an MCH service;

(2) The proportion of all visits in which a client receives HIV counselling.

Results

Across facilities, the proportion of visits in which both HIV/STI and MCH services were received varied considerably, e.g., from 9%-49% in 2009. HIV/STI services were integrated most frequently with child health, ante-natal care (ANC) and family planning – the most common reasons for women's attendance – and least often with post-natal care (PNC) and cervical screening. There was no meaningful difference in integration over time by design group, and considerable heterogeneity across facilities. Receipt of integrated services increased in one intervention and two comparison facilities, where HIV counseling also rose, and fell in one intervention and two comparison facilities.

Conclusions

Provision of HIV/STI services with MCH care occurred at all facilities, yet relatively few women receive integrated services. Increases in integration were driven by increases in HIV counseling while sharp declines in some facilities indicate integration is difficult to sustain. Opportunities for intensifying HIV integration lie with ANC, child health and family planning, while HIV-PNC integration will remain limited until more women attend PNC.

Trial registry and number

Current Controlled Trials NCT01694862

ARTICLE SUMMARY

Article focus

- Maternal health care may provide an entry point for HIV services in high HIV-prevalence settings, yet little is known about actual integration of HIV with maternal care – or how integrated provision can be improved – in public sector facilities.
- Client flow assessments were conducted over five days in MCH units of eight facilities in Swaziland in 2009, 2010 and 2012 (N=8263 visits tracked) to determine the extent to which HIV/STI services were received with MCH services in the same visit, and in what combinations.
- We also assessed whether these outcomes improved with time in facilities which received an intervention designed to strengthen integration of HIV into post-natal care services (the Integra Initiative).

Key messages

- Some provision of HIV/STI services with MCH care occurred at all facilities, indicating a capacity to integrate services in the public sector, yet relatively few women receive integrated services.
- In three facilities, increases in integration over time were driven by increases in HIV counselling. Sharp declines in other facilities suggest integration is difficult to sustain, given frequent staff rotation and vertical HIV treatment campaigns that can divert resources for integration.

- There was no evidence of an increase in integration in three of four intervention facilities. Impact of the intervention to strengthen integration of HIV into PNC will remain limited until more women attend PNC; the best opportunities for scaling up HIV integration may lie with ANC, child health and family planning, given their frequent use.

Strengths and limitations of this study

- The main strength is the scale and novelty of client flow data in public sector facilities in sub-Saharan Africa, offering detailed combinations of services received in every consultation. Such detail is typically unavailable from routine health information systems.
- An important limitation is the logistical challenge in conducting client flow assessments simultaneously across eight government facilities, affecting comparability of data across facilities and time points.

INTRODUCTION

Maternal mortality and HIV have been described as "intersecting epidemics" which must be simultaneously tackled.[1, 2] In the setting for this study – Swaziland, where more than 40% of pregnant women are infected with HIV – HIV is intimately linked with maternal mortality and hindering efforts to lower maternal death rates.[3, 4]

Since the International Conference on Population and Development in 1994, a strong case has been made for integrating HIV into sexual and reproductive health (SRH) with potential benefits for both clients and facilities.[5, 6] Integration can simultaneously address clients' reproductive health goals and their needs for HIV prevention and treatment and PMTCT.[7] Process evaluations of integrated HIV and family planning (FP) services indicate that facilities can gain by increasing the provision, uptake and efficiency of services while improving client satisfaction and reducing HIV-related stigma in clinics.[8]

More recently, the case for expanding integration of HIV/AIDS services to maternal, neonatal, child health and nutrition, including family planning, is supported in a systematic review which concludes that integration of such services is feasible to implement.[9] Furthermore, such integration can yield positive effects on the quality of services as well as client outcomes including contraceptive use, antiretroviral therapy in pregnancy, and HIV testing.[9]

Maternal and child health services can thus serve as entry points for HIV prevention, treatment and care, particularly in contexts of high HIV prevalence. Yet little is known about existing

levels of integration, particularly in public sector health facilities, or how provision can be improved and scaled up.[8]

The Integra Initiative was designed to evaluate different models of SRH-HIV integration, including the integration of HIV/STI services with post-natal care (PNC) in Swaziland.[10] As part of the Integra Initiative, this study analysed client flow data collected in eight public sector facilities in Swaziland in 2009, 2010 and 2012, to determine whether clients seeking maternal and child health services (MCH) receive integrated services, and if so, in what combinations of HIV/STI and MCH services. We also sought to understand how the receipt of integrated services differs over time and between facilities which did and did not receive the Integra intervention. We hoped the answers would help identify gaps and opportunities for integrating HIV within maternal health services and achieving universal access to both.

METHODS

Data Collection

As part of Integra's non-randomised design, eight public sector facilities were selected from three of Swaziland's four regions. Four facilities were purposively designated as Intervention facilities (referred to as Facilities A-D), based on their previous participation in an operations research study by Population Council, one of the Integra institutional partners.[11] Four comparison facilities were selected based on their distance from intervention sites (to avoid contamination) and no current provision of integrated HIV-PNC services (Facilities E-H).

In the intervention facilities, between October 2009 and December 2010, Integra delivered a programme designed to strengthen and maintain the provision of integrated HIV and PNC services. The intervention components included: (a) a training package to facilitate mentoring of front-line health providers by more experienced providers; (b) job aids to promote integration, including the Balanced Counselling Strategy Plus (BCS+) toolkit containing an algorithm, counselling cards and brochures to support counselling, including HIV service provision, within PNC consultations;[11, 12] and (c) ongoing support to discuss role clarification, organisational change, referral/linkages and management of service statistics.

The client flow assessments (CFAs) comprise one data component of the Integra evaluation, and were designed to capture service utilisation patterns among clients seeking MCH services, given that data on integrated service provision were not available from routine clinical data (which collect data on different services in separate registers). Specifically, CFAs were conducted in all study facilities in November 2009, December 2010, and August 2012. Over a period of five days, Monday through Friday, all clients entering the facility for MCH health services were given a client flow form by teams of trained local researchers or service providers. Clients carried the form throughout their visit, and each service provider they saw completed the form in their consultation room/cubicle, indicating session start/end times, the service(s) received by the client and any referrals to other providers. The first CFA (late November 2009) was conducted soon after the intervention began in October 2009, but before it was fully implemented in any site.

Data analysis

We defined our unit of analysis to be a visit, which comprised all providers seen and services received in the same day for each client, as captured on the client assessment form. Clients were either a single adult or an adult plus a child. We excluded visits of males aged 12 years or over, to focus on maternal and child health services. The age of 12 was selected as reproductive health services were received by females as young as 12.

The following primary and secondary outcomes were calculated for each facility and time point:

1. Receipt of integrated HIV-MCH services: the proportion of all visits in which a client receives any HIV or STI service, specifically: HIV testing, counselling or treatment; PMTCT; or STI counselling or testing

   and

   any of the following MCH services: FP counselling or provision; PNC for mother or baby; cervical cancer screening; child health (including weighing and immunisations); and antenatal care (ANC).

   We hypothesised that HIV-MCH integration would increase in facilities which received the Integra intervention.

2. Receipt of HIV counselling: the proportion of all visits in which a client receives HIV counselling.

   We hypothesised that HIV counselling would increase as a result of the Integra intervention, regardless of women's need for HIV testing or treatment which are not

constant (medical histories, including the need for testing or treatment, were not captured on the CFA form).

We also sought to describe which MCH services were most commonly combined with HIV/STI services, by calculating the percentage of visits in which an HIV/STI service was combined with each type of MCH service. We examined the change over time in the proportion of visits receiving integrated HIV/STI and MCH services (primary outcome) and HIV counselling (secondary outcome) separately for each facility. We used the 95% confidence interval around the difference (in the 2010 and 2012 proportions compared to 2009) as an indication of whether the observed change was due to chance (if it included the null value of zero).

To examine differences in the key outcomes by design group, we calculated the risk difference in 2010 and 2012 (each compared to 2009) for intervention versus comparison facilities for both the primary and secondary outcomes using a two-stage approach. In the first stage we estimated facility-level residuals by fitting a logistic regression model and including terms to adjust for baseline value (corresponding proportion of visits in 2009), average annual client load (<10000, 10000+), and rural/urban status. Difference residuals were then obtained as the difference between the observed and predicted values (divided by facility size). In the second stage we analysed the facility-level residuals, based on the assumption that in the absence of any intervention effect the residuals should be distributed normally with no systematic difference between the intervention and comparison arms. Difference residuals were analysed using linear regression including an interaction term representing the difference in 'change from baseline' between the design groups.

Ethics Statement

Ethics approval for the client flow assessments was obtained from the Swaziland Scientific Review Board, the London School of Hygiene & Tropical Medicine and the Population Council Institutional Review Board.

RESULTS

Across eight facilities, 3261 visits were tracked in November 2009, 2086 visits in December 2010, and 2916 in August 2012. Table 1 presents general characteristics of the visits and facilities. Overall, about half of the visits included an adult female and child (under 12 years), versus an adult client only, although this proportion varied across facilities (range: 28%-95%). In almost all facilities, clients received on average more than one service during their visit, with many receiving two or more. Each year, approximately eight percent of clients did not receive any service or referral during their visit, with the highest proportions in the facilities with highest client load (e.g., 18% of clients in Facility B and 31% in Facility D in 2010). In all facilities, and in both years, child health services were either the first or second most common service received. Family planning counselling or provision, and ante-natal care, were among the top three services for most facilities. Across facilities, the least common services received were post-natal care and cervical screening (See Supplementary Table 1).

Table 1. Characteristics of the facilities, visits and services tracked in 2009, 2010 and 2012

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	590	475	532	855	263	408	211	184	241	753	411	607
Client category												
Adult (12+ years) only	395 (66.9%)	196 (41.3%)	211 (39.7%)	443 (51.8%)	153 (58.2%)	172 (42.2%)	144 (68.2%)	87 (47.3%)	82 (34%)	310 (41.2%)	197 (47.9%)	408 (67.2%)
Adult + child	176 (29.8%)	278 (58.5%)	320 (60.2%)	153 (17.9%)	109 (41.4%)	236 (57.8%)	64 (30.3%)	97 (52.7%)	156 (64.7%)	93 (12.4%)	213 (51.8%)	198 (32.6%)
Adult age												
Mean [sd]	26.2 [6.4]	26.2 [7.2]	26.3 [6.5]	26.8 [8.2]	27 [7.2]	26.6 [7.3]	28.5 [8.4]	26.8 [8]	27.7 [8.5]	27.6 [7.4]	27.3 [8.4]	31.3 [10.2]
Missing	9 (1.5%)	258 (54.3%)	17 (3.2%)	357 (41.8%)	40 (15.2%)	13 (3.2%)	2 (.9%)	2 (1.1%)	1 (.4%)	382 (50.7%)	165 (40.1%)	12 (2%)
Services received per visit												
None	37 (6.3%)	24 (5.1%)	88 (16.5%)	134 (15.7%)	47 (17.9%)	23 (5.6%)	11 (5.2%)	6 (3.3%)	32 (13.3%)	93 (12.4%)	129 (31.4%)	29 (4.8%)
One	319 (54.1%)	106 (22.3%)	192 (36.1%)	479 (56%)	145 (55.1%)	208 (51%)	47 (22.3%)	57 (31%)	114 (47.3%)	246 (32.7%)	135 (32.8%)	238 (39.2%)
Two or more	234 (39.7%)	345 (72.6%)	252 (47.4%)	242 (28.3%)	71 (27%)	177 (43.4%)	153 (72.5%)	121 (65.8%)	95 (39.4%)	414 (55%)	147 (35.8%)	340 (56%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.3]	2.5 [1.4]	2.6 [2]	1.6 [1.1]	1.4 [.8]	2 [1.6]	2.6 [1.7]	2 [1]	1.9 [1.3]	2.1 [1.2]	2 [1.3]	2 [1.3]
Mean [sd] providers seen	1.3 [.5]	1.5 [.5]	1.6 [.9]	1.2 [.4]	1 [.2]	1.4 [.7]	1.3 [.5]	1.1 [.4]	1.3 [.5]	1.5 [.7]	1.5 [.7]	1.1 [.3]
Visits where no services were either referred or received	36 (6.1%)	22 (4.6%)	88 (16.5%)	112 (13.1%)	47 (17.9%)	15 (3.7%)	7 (3.3%)	6 (3.3%)	16 (6.6%)	81 (10.8%)	69 (16.8%)	29 (4.8%)
Average annual client load*		32,321			65,794			9,974			40,485	
Setting (urban/rural)		Urban			Urban			Peri-urban			Urban	

Comparison	Facility E			Facility F			Facility G			Facility H		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	220	215	380	317	333	347	146	170	114	169	35	287
Client category												
Adult (12+ years) only	131 (59.5%)	72 (33.5%)	234 (61.6%)	194 (61.2%)	183 (55%)	154 (44.4%)	74 (50.7%)	106 (62.4%)	47 (41.2%)	110 (65.1%)	2 (5.7%)	178 (62%)
Adult + child	78 (35.5%)	143 (66.5%)	145 (38.2%)	117 (36.9%)	150 (45%)	193 (55.6%)	69 (47.3%)	64 (37.6%)	67 (58.8%)	48 (28.4%)	33 (94.3%)	107 (37.3%)
Adult age												
Mean [sd]	26 [7.5]	26 [5.9]	34.5 [12.6]	26.1 [6.2]	26.4 [6.3]	26.5 [7.4]	27.4 [7.8]	31.4 [10.8]	26.5 [7.2]	25.1 [6]	29.5 [10.6]	30.9 [11.9]
Missing	1 (.5%)	95 (44.2%)	53 (13.9%)	5 (1.6%)	124 (37.2%)	9 (2.6%)	0 (0%)	6 (3.5%)	5 (4.4%)	0 (0%)	33 (94.3%)	67 (23.3%)
Services received per visit												
None	10 (4.5%)	3 (1.4%)	13 (3.4%)	1 (.3%)	5 (1.5%)	8 (2.3%)	11 (7.5%)	6 (3.5%)	14 (12.3%)	31 (18.3%)	0 (0%)	29 (10.1%)
One	99 (45%)	34 (15.8%)	45 (11.8%)	100 (31.5%)	177 (53.2%)	46 (13.3%)	19 (13%)	84 (49.4%)	32 (28.1%)	32 (18.9%)	8 (22.9%)	155 (54%)
Two or more	111 (50.5%)	178 (82.8%)	322 (84.7%)	216 (68.1%)	151 (45.3%)	293 (84.4%)	116 (79.5%)	80 (47.1%)	68 (59.6%)	106 (62.7%)	27 (77.1%)	103 (35.9%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.1]	2.4 [1.1]	3.2 [1.6]	2.3 [1.6]	1.6 [.9]	3.4 [1.6]	3.2 [1.6]	1.6 [.6]	2.6 [1.6]	2.7 [1.6]	2.8 [1.3]	1.8 [1.5]
Mean [sd] providers seen	1.3 [.5]	1.1 [.2]	1.7 [.7]	1.8 [.8]	1 [.2]	1.3 [.6]	1.5 [.5]	1.4 [.6]	1.3 [.6]	1.4 [.6]	1.1 [.3]	1.2 [.5]
Visits where no services were either referred or received	9 (4.1%)	2 (.9%)	12 (3.2%)	1 (.3%)	5 (1.5%)	7 (2%)	11 (7.5%)	5 (2.9%)	8 (7%)	3 (1.8%)	0 (0%)	21 (7.3%)
Average annual client load*		7,736			28,202			9,674			6,959	
Setting (urban/rural)		Rural			Peri-urban			Rural			Rural	

*Annual client load taken from health facility assessments conducted for the Integra Initiative in 2010. All tables are N (%) unless indicated otherwise.

Receipt of integrated HIV-MCH services

There was evidence of HIV-MCH integration at all facilities and time points, although the extent of integration (the proportion of visits in which integrated HIV-MCH services were received) varied by facility: specifically, between 9% and 49% in 2009, 2%-22% in 2010 and 10-44% in 2012 (see Table 2). In the short-term, five facilities experienced declines in integration between 2009 and 2010: by seven and 13 percentage points in two intervention facilities; and by 12, 19 and 48 percentage points in three comparison facilities. In the longer-term, integration increased in one intervention site (Facility A, from 9% in 2009 to 17% of visits in 2012) and two comparison facilities (Facility E, from 11% to 37%; and Facility F, from 16% to 44% in 2012, after experiencing an initial drop to 9% in 2010). Meanwhile, integration fell in one intervention site (Facility C, from 33% to 16%) and two comparison facilities (Facility G, from 49% to 27%; Facility H, from 25% to 14%). Two intervention facilities (B and D) experienced no significant change in HIV-MCH integration between 2009 and 2012.

Table 2. Proportion of visits receiving the primary and secondary outcomes, by facility, year and design group

	Intervention									
	Facility A		Facility B		Facility C		Facility D		All intervention facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	54/590 (9.2%)		83/855 (9.7%)		69/211 (32.7%)		98/753 (13%)		16.1%	
2010	74/475 (15.6%)	6.4% (2.4, 10.4)	6/263 (2.3%)	-7.4% (-10.1, -4.7)	38/184 (20.7%)	-12% (-20.7, -3.4)	73/411 (17.8%)	4.7% (.3, 9.2)	14.1%	-0.8% (-19.3, 17.7)
2012	91/532 (17.1%)	8% (4, 11.9)	40/408 (9.8%)	.1% (-3.4, 3.6)	38/241 (15.8%)	-16.9% (-24.8, -9.1)	78/607 (12.9%)	-.2% (-3.8, 3.4)	13.9%	-8.1% (-27.0, 10.8)
Outcome 2: HIV counselling received										
2009	38/590 (6.4%)		38/855 (4.4%)		56/211 (26.5%)		24/753 (3.2%)		10.2%	
2010	72/475 (15.2%)	8.7% (4.9, 12.5)	20/263 (7.6%)	3.2% (-.3, 6.6)	30/184 (16.3%)	-10.2% (-18.2, -2.2)	54/411 (13.1%)	10% (6.5, 13.5)	13.1%	0.1% (-13.0, 13.2)
2012	81/532 (15.2%)	8.8% (5.1, 12.4)	13/408 (3.2%)	-1.3% (-3.5, .9)	21/241 (8.7%)	-17.8% (-24.8, -10.9	53/607 (8.7%)	5.5% (3, 8.1)	9.0%	-11% (-32.6, 10.6)
	Comparison									
	Facility E		Facility F		Facility G		Facility H		All comparison facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	24/220 (10.9%)		52/317 (16.4%)		72/146 (49.3%)		42/169 (24.9%)		25.4%	
2010	57/215 (26.5%)	15.6% (8.4, 22.8)	30/333 (9%)	-7.4% (-12.5, -2.3)	6/170 (3.5%)	-45.8% (-54.4, -37.2	5/35 (14.3%)	-10.6% (-23.9, 2.7)	13.3%	-10.8% (-29.2, 7.7)
2012	141/380 (37.1%)	26.2% (19.8, 32.6)	154/347 (44.4%)	28% (21.3, 34.6)	31/114 (27.2%)	-22.1% (-33.6, -10.6	39/287 (13.6%)	-11.3% (-18.9, -3.6)	30.6%	0.6% (-19.5, 18.2)
Outcome 2: HIV counselling received										
2009	10/220 (4.5%)		27/317 (8.5%)		44/146 (30.1%)		24/169 (14.2%)		14.4%	
2010	29/215 (13.5%)	8.9% (3.6, 14.3)	13/333 (3.9%)	-4.6% (-8.3, -.9)	4/170 (2.4%)	-27.8% (-35.6, -20)	3/35 (8.6%)	-5.6% (-16.3, 5)	7.1%	-10.1% (-23.1, 3.0)
2012	114/380 (30%)	25.5% (20.1, 30.8)	202/347 (58.2%)	49.7% (43.7, 55.7)	18/114 (15.8%)	-14.3% (-24.4, -4.3)	18/287 (6.3%)	-7.9% (-13.9, -2)	27.6%	3.4% (-18.2, 25.0)

†Unadjusted cluster-level proportions analysed separately at each time point. ‡Change from baseline adjusted for facility size and rural/urban status. All confidence intervals are at 95% confidence level.

Combinations of HIV/STI and MCH services received

In 2009, at least one client in every facility received each type of HIV-MCH integration investigated; that is, one or more clients received integration of HIV-FP (provision and counselling), HIV-ANC, HIV-PNC (for mother or baby), HIV-cervical screening (HIV-CS), and HIV-child health (HIV-CH). Figure 1 shows the proportion of visits in which each service combination was received at each facility. The most common integration in 2009 was HIV with child health services (up to 33% of all visits in Facility G), followed by HIV-ANC and HIV-FP (counselling or provision). Less frequent was integration of HIV services with PNC (a maximum of 6% of visits in Facility C) or cervical screening (maximum 6% of visits in Facility D).

In 2010, integration of HIV services with the MCH services no longer occurred in every facility. For example, in three facilities there were zero visits in which integration of HIV services and family planning occurred. And integration of HIV services and cervical screening services disappeared in one intervention and all comparison facilities, while HIV-ANC and HIV-PNC integration disappeared in two comparison sites. Excluding the latter two sites, integration of HIV-ANC was the most common type of integration in 2010. Between 2009 and 2012, HIV integration with FP counselling rose in facilities A, E and F - the same facilities that experienced increases in overall HIV-MCH integration. HIV-FP counselling integration declined in the other facilities, and integration of HIV and PNC services – the focus of the intervention – remained low in all facilities over time.

Receipt of HIV counselling

As a secondary outcome, we hypothesised that HIV counselling would increase in the intervention facilities. Table 2 shows that the proportion of visits in which a client received HIV

counselling increased between 2009 and 2012 in two intervention (A,D) and two comparison facilities (E,F), and declined in two intervention sites (Facility C) and two comparison sites (G,H). The absolute numbers of visits that included HIV counselling are presented in Figure 2, which also shows that HIV counselling was more often provided in combination with an MCH service than alone. Specifically, HIV counselling was most often provided together with ANC, FP counselling or child health services (data not shown).

Evidence of an intervention effect

As shown in Table 2 (final column), there was no statistical evidence that integration increased over time in intervention facilities as a group. On average, the intervention facilities provided integrated services in 16 percent of visits in 2009 and 14 percent in both 2010 and 2012. Nor was there statistical evidence that the proportion of visits providing HIV counselling increased in the intervention group (averaging 10% in 2009 and 9% in 2012). In the comparison group, both overall HIV-MCH integration and HIV counselling increased between 2009 and 2012 (by 5 and 13 percentage points) after experiencing a decline in 2010. For these differences, 95% confidence intervals include the null value of zero. Between the intervention and comparison groups, there was no statistical difference in change from baseline levels of HIV-MCH integration or provision of HIV counselling (data not shown).

DISCUSSION

With what we believe are among the most detailed data on HIV-MCH integration in the public sector in Africa, we have been able to assess the extent to which clients are receiving integrated services, and in which combinations over time. The client flow assessments have

shown that HIV/STI services (counselling, testing and treatment) are being integrated with a wide range of MCH services, including family planning, ante-natal care, post-natal care, cervical screening and child health services. This is evidence of the capacity to integrate, in large urban facilities as well as small, rural facilities across Swaziland. It also fills a current gap in evidence – regarding the feasibility of integrating HIV services with infant/child health services, and postnatal/postpartum services. A recent systematic review of integration evaluations identified both models as 'inadequately studied' to date.[9]

Nevertheless, integration occurred in a minority of visits and varied considerably across facilities. Furthermore, the level of integration fell in three of the eight facilities between 2009 and 2012. The facility with the highest level of integration in 2009 dropped to the lowest a year later (from 49% to <2%). This may be explained by the existence of an NGO campaign to increase access to ART in the area of that facility during the 2010 assessment, as HIV treatment appears to have displaced almost all other HIV and MCH services. This suggests that integration can be susceptible to vertical programmes or competing priorities, particularly in smaller facilities where the 2010 declines in integration were steepest.

It is also possible that integration declined in settings where clients did not need HIV services with every visit. The CFA did not capture clients' history or need for such services, and thus we cannot interpret observed changes in their provision. For this reason we were particularly interested in the provision of HIV counselling, which can be promoted regardless of need for testing or treatment. HIV counselling rose in two intervention and two comparison facilities. In the three sites where HIV-MCH integration rose, this appeared to be driven by an increase in

HIV counselling. That HIV counselling was most often provided with an MCH service rather than alone suggests it has an important role to play in scaling up integration, but requires a concerted effort to sustain its provision.

The most common form of integration observed was between HIV services and child health, followed by ANC and FP. These services may offer the best opportunities for integration with HIV, given most women attended for child health, ANC and FP services. This is particularly encouraging in light of a recent review concluding that uptake of PMTCT in sub-Saharan Africa is inadequate, but improves with an integrated family-centred approach, for example, if HIV treatment is provided at antenatal clinics.[7]

Less common was integration of HIV/STI with PNC or cervical screening, most likely due to the lower number of clients receiving PNC and cervical screening relative to other services (or PNC clients may have received HIV/STI testing in recent ANC visits). This suggests that effectiveness of the Integra Initiative – which focuses on HIV-PNC integration in Swaziland – may be limited until more clients attend for PNC services. And this may require further investment in equipment and training for PNC (as well as cervical screening, as only one facility had the capacity to offer immediate cryotherapy) as well as demand creation to increase service uptake.

The formal comparison of integration by study design (intervention versus comparison sites) showed no statistical difference in HIV-MCH integration over time. Neither was there a meaningful difference in the receipt of HIV counselling in the intervention group over time.

Limitations and the challenges of embedding research in 'real-world' settings

The observed changes in levels of integration, and absence of an intervention effect, could be due to a number of factors which we were unable to account for given the non-randomised design, as well as challenges implementing the protocol as intended.

With regard to design: in a small country with limited number of facilities, intervention sites could not be matched with similar-sized comparison facilities without risk of contamination. This resulted in systematically different groups, with intervention facilities primarily large and urban, and comparison facilities mostly small and rural. Given the resulting heterogeneity, we felt it was more informative to compare changes by facility than study design. The wide variation we observed across facilities likely reflects the different capacities and infrastructure available to provide integrated services, i.e., facilities can not follow the same 'blue print' for integration.

Some observed changes may also be due to 'seasonal' differences in 2009 and 2010. For logistical reasons, the client flow assessments were delayed in 2010 and could not be conducted in the same week in November as in 2009. And specific circumstances in some facilities meant the assessments could not be simultaneous in all sites, as the protocol had intended. Most assessments were delayed until the week before Christmas which may account for the smaller number of clients in most facilities in 2010. This timing may have affected the range of services provided and may account for different patterns of integration. Smaller, rural

facilities – where the drops in integration were the steepest - may be impacted more than large, rural sites during such holiday periods.

It is also possible that provision of HIV and MCH services may fluctuate frequently or periodically, in patterns we could not detect from 5-day 'snapshot' assessments (regardless of their specific timing). It may be more informative to monitor over a longer period, for more representative data. Yet, the 5-day assessments proved challenging and resource-intensive to implement, and longer versions may be prohibitive in many settings. Strengthening routine data collection systems may be preferable, but many existing systems record services individually in separate registers, and are thus unable to document service integration without fundamentally changing the system. It was this barrier that led us to develop the client flow assessment.

Conclusions

The client flow assessment provided rich detail about the range and combinations of services received by large number of clients. This was valuable for understanding whether and how HIV and MCH services are integrated in practice. The data confirm that, in a context of high HIV prevalence, capacity exists in public sector services for integration of HIV services into MCH care. In particular, ANC, child health and family planning provide promising entry-points for reaching the largest number of women. Sustaining HIV-MCH integration may require concerted effort over time. The study limitations reflect the challenges of embedding rigorous research into existing and diverse facilities (i.e., 'real-world' evaluations), and difficulties in recording the provision of integrated services.

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Author contributions

SM, JK, CW, KC, RN helped to design the data collection. JK managed the data collection. JF and WZ cleaned and managed the datasets. IB and JF led the analysis. All authors provided input into the data interpretation. IB drafted the manuscript. All authors read and commented on a complete draft.

Data sharing

The dataset will be made available via an LSHTM repository upon completion of the Integra Initiative.

Competing interests statement

The authors have declared that no competing interests exist.

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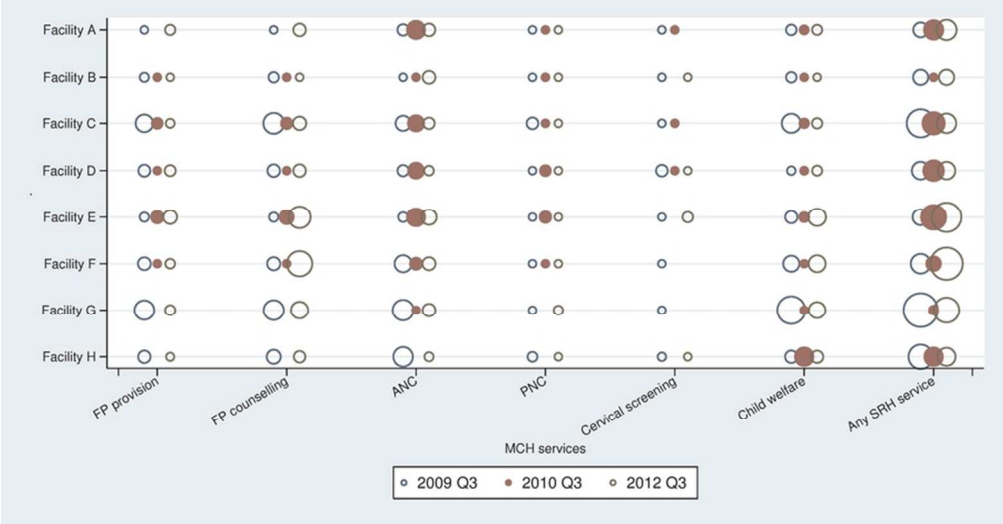

Figure 1. Proportion of visits receiving any HIV/STI service combined with MCH services, by facility and MCH service.
Note: The size of the bubble is proportional to the percentage of visits. The smallest bubbles represent <2.5%; the largest bubble represents 49%.

76x39mm (300 x 300 DPI)

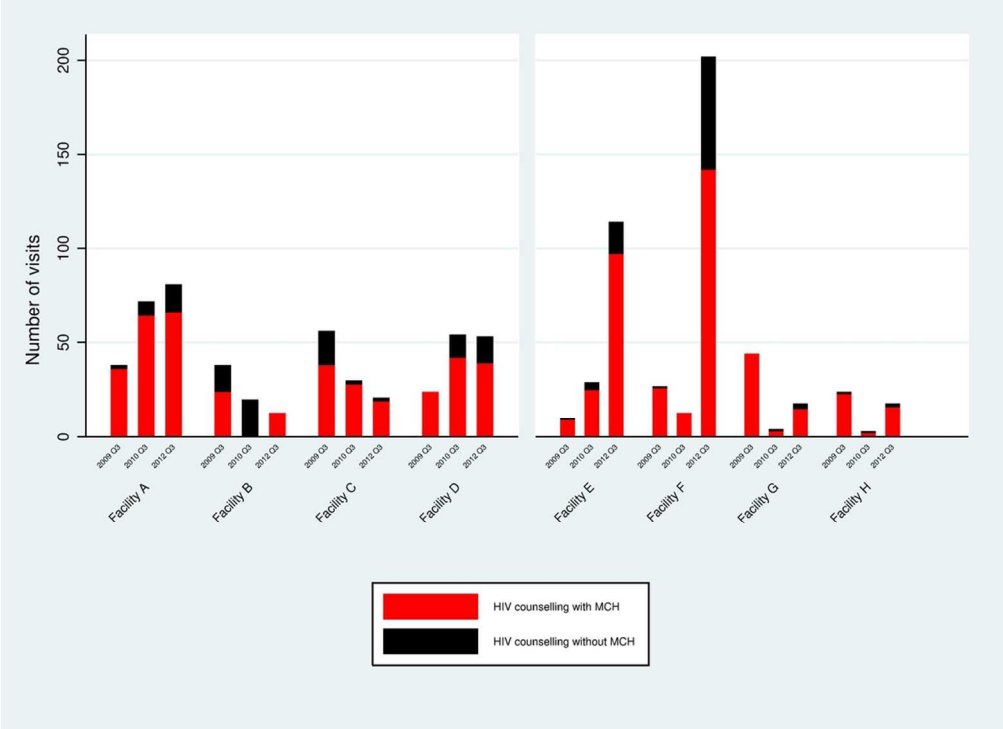

Figure 2. Number of visits receiving any HIV counselling services, by facility and integration with MCH services
101x73mm (300 x 300 DPI)

Supplementary Table 1. Proportion of visits in which key HIV/STI and MCH services were received, by facility and year

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
N	590	475	532	855	263	408	211	184	241	753	411	607
HIV/STI services received												
HIV testing	40 (6.8%)	39 (8.2%)	125 (23.5%)	20 (2.3%)	6 (2.3%)	14 (3.4%)	13 (6.2%)	8 (4.3%)	15 (6.2%)	10 (1.3%)	29 (7.1%)	33 (5.4%)
HIV counselling	38 (6.4%)	72 (15.2%)	81 (15.2%)	38 (4.4%)	20 (7.6%)	13 (3.2%)	56 (26.5%)	30 (16.3%)	21 (8.7%)	24 (3.2%)	54 (13.1%)	53 (8.7%)
HIV treatment	4 (.7%)	9 (1.9%)	14 (2.6%)	139 (16.3%)	21 (8%)	70 (17.2%)	29 (13.7%)	10 (5.4%)	108 (44.8%)	65 (8.6%)	1 (.2%)	78 (12.9%)
PMTCT	0 (0%)	30 (6.3%)	27 (5.1%)	0 (0%)	1 (.4%)	24 (5.9%)	0 (0%)	7 (3.8%)	7 (2.9%)	0 (0%)	71 (17.3%)	28 (4.6%)
STI counselling & testing	13 (2.2%)	0 (0%)	49 (9.2%)	65 (7.6%)	49 (18.6%)	9 (2.2%)	46 (21.8%)	1 (.5%)	5 (2.1%)	59 (7.8%)	5 (1.2%)	28 (4.6%)
Any HIV/STI service	57 (9.7%)	83 (17.5%)	202 (38%)	218 (25.5%)	74 (28.1%)	109 (26.7%)	92 (43.6%)	47 (25.5%)	135 (56%)	138 (18.3%)	87 (21.2%)	159 (26.2%)
MCH services received												
Family planning provision	176 (29.8%)	97 (20.4%)	105 (19.7%)	147 (17.2%)	38 (14.4%)	63 (15.4%)	56 (26.5%)	46 (25%)	18 (7.5%)	67 (8.9%)	40 (9.7%)	100 (16.5%)
Family planning counselling	65 (11%)	44 (9.3%)	93 (17.5%)	84 (9.8%)	9 (3.4%)	52 (12.7%)	70 (33.2%)	19 (10.3%)	33 (13.7%)	77 (10.2%)	40 (9.7%)	130 (21.4%)
ANC	145 (24.6%)	74 (15.6%)	49 (9.2%)	102 (11.9%)	19 (7.2%)	78 (19.1%)	49 (23.2%)	46 (25%)	20 (8.3%)	322 (42.8%)	48 (11.7%)	86 (14.2%)
PNC (mother or baby)	53 (9%)	35 (7.4%)	11 (2.1%)	32 (3.7%)	10 (3.8%)	16 (3.9%)	16 (7.6%)	9 (4.9%)	10 (4.1%)	54 (7.2%)	23 (5.6%)	28 (4.6%)
Cervical screen	2 (.3%)	1 (.2%)	3 (.6%)	8 (.9%)	0 (0%)	2 (.5%)	3 (1.4%)	1 (.5%)	0 (0%)	348 (46.2%)	1 (.2%)	11 (1.8%)
Child health (incl. Immunization)	320 (54.2%)	277 (58.3%)	174 (32.7%)	319 (37.3%)	90 (34.2%)	157 (38.5%)	93 (44.1%)	81 (44%)	47 (19.5%)	155 (20.6%)	128 (31.1%)	268 (44.2%)
Other reproductive health service	1 (.2%)	0 (0%)	1 (.2%)	11 (1.3%)	7 (2.7%)	4 (1%)	2 (.9%)	1 (.5%)	5 (2.1%)	58 (7.7%)	27 (6.6%)	0 (0%)
Any MCH service	550 (93.2%)	441 (92.8%)	326 (61.3%)	543 (63.5%)	147 (55.9%)	313 (76.7%)	175 (82.9%)	167 (90.8%)	106 (44%)	610 (81%)	256 (62.3%)	476 (78.4%)
Comparison	**Facility E**			**Facility F**			**Facility G**			**Facility H**		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
N	220	215	380	317	333	347	146	170	114	169	35	287
HIV/STI services received												
HIV testing	14 (6.4%)	16 (7.4%)	33 (8.7%)	14 (4.4%)	4 (1.2%)	16 (4.6%)	19 (13%)	0 (0%)	16 (14%)	22 (13%)	0 (0%)	6 (2.1%)
HIV counselling	10 (4.5%)	29 (13.5%)	114 (30%)	27 (8.5%)	13 (3.9%)	202 (58.2%)	44 (30.1%)	4 (2.4%)	18 (15.8%)	24 (14.2%)	3 (8.6%)	18 (6.3%)
HIV treatment	9 (4.1%)	12 (5.6%)	31 (8.2%)	18 (5.7%)	7 (2.1%)	173 (49.9%)	41 (28.1%)	78 (45.9%)	48 (42.1%)	4 (2.4%)	0 (0%)	96 (33.4%)
PMTCT	0 (0%)	28 (13%)	50 (13.2%)	0 (0%)	18 (5.4%)	15 (4.3%)	0 (0%)	9 (5.3%)	7 (6.1%)	0 (0%)	6 (17.1%)	16 (5.6%)
STI counselling & testing	8 (3.6%)	13 (6%)	43 (11.3%)	24 (7.6%)	0 (0%)	101 (29.1%)	15 (10.3%)	0 (0%)	3 (2.6%)	25 (14.8%)	0 (0%)	7 (2.4%)
Any HIV/STI service	30 (13.6%)	64 (29.8%)	176 (46.3%)	57 (18%)	36 (10.8%)	253 (72.9%)	74 (50.7%)	91 (53.5%)	69 (60.5%)	45 (26.6%)	7 (20%)	123 (42.9%)
MCH services received												
Family planning provision	52 (23.6%)	57 (26.5%)	100 (26.3%)	73 (23%)	128 (38.4%)	39 (11.2%)	47 (32.2%)	12 (7.1%)	17 (14.9%)	43 (25.4%)	8 (22.9%)	32 (11.1%)
Family planning counselling	23 (10.5%)	64 (29.8%)	148 (38.9%)	41 (12.9%)	38 (11.4%)	117 (33.7%)	44 (30.1%)	6 (3.5%)	23 (20.2%)	43 (25.4%)	7 (20%)	50 (17.4%)
ANC	45 (20.5%)	41 (19.1%)	58 (15.3%)	199 (62.8%)	83 (24.9%)	40 (11.5%)	49 (33.6%)	7 (4.1%)	13 (11.4%)	49 (29%)	0 (0%)	21 (7.3%)
PNC (mother or baby)	2 (.9%)	17 (7.9%)	14 (3.7%)	17 (5.4%)	20 (6%)	3 (.9%)	5 (3.4%)	1 (.6%)	9 (7.9%)	11 (6.5%)	1 (2.9%)	16 (5.6%)
Cervical screen	2 (.9%)	0 (0%)	23 (6.1%)	3 (.9%)	0 (0%)	0 (0%)	2 (1.4%)	0 (0%)	0 (0%)	6 (3.6%)	0 (0%)	2 (.7%)
Child health (incl. Immunization)	135 (61.4%)	102 (47.4%)	118 (31.1%)	198 (62.5%)	111 (33.3%)	84 (24.2%)	81 (55.5%)	43 (25.3%)	22 (19.3%)	62 (36.7%)	31 (88.6%)	89 (31%)
Other reproductive health service	0 (0%)	0 (0%)	3 (.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1.8%)	1 (.6%)	0 (0%)	3 (1%)
Any MCH service	204 (92.7%)	204 (94.9%)	312 (82.1%)	311 (98.1%)	322 (96.7%)	238 (68.6%)	133 (91.1%)	63 (37.1%)	61 (53.5%)	133 (78.7%)	33 (94.3%)	165 (57.5%)

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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Title

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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ABSTRACT

Objective

Maternal and child health (MCH) care may provide an entry point for HIV services in high HIV-prevalence settings. Our objective was to assess integration of HIV with MCH services in public sector facilities in Swaziland.

Design

In 2009, 2010 and 2012, client flow assessments were conducted over five days in the MCH units of eight government facilities, purposively selected as intervention or comparison sites.

Participants

8263 MCH visits with female clients were tracked: 3261 in 2009; 2086 in 2010; and 2916 in 2012.

Intervention

Activities and resources to strengthen integration of HIV services into post-natal care, 2009 - 2010.

Main outcome measures

(1) The proportion of all visits in which an HIV/STI testing, counselling or treatment was received together with an MCH service;

(2) The proportion of all visits in which a client receives HIV counselling.

Results

Across facilities, the proportion of visits in which both HIV/STI and MCH services were received varied considerably, e.g., from 9%-49% in 2009. HIV/STI services were integrated most frequently with child health, ante-natal care (ANC) and family planning – the most common reasons for women's attendance – and least often with post-natal care (PNC) and cervical screening. There was no meaningful difference in integration over time by design group, and considerable heterogeneity across facilities. Receipt of integrated services increased in one intervention and two comparison facilities, where HIV counseling also rose, and fell in one intervention and two comparison facilities.

Conclusions

Provision of HIV/STI services with MCH care occurred at all facilities, yet relatively few women receive integrated services. Increases in integration were driven by increases in HIV counseling while sharp declines in some facilities indicate integration is difficult to sustain. Opportunities for intensifying HIV integration lie with ANC, child health and family planning, while HIV-PNC integration will remain limited until more women attend PNC.

Trial registry and number

Current Controlled Trials NCT01694862

ARTICLE SUMMARY

Article focus

- Maternal health care may provide an entry point for HIV services in high HIV-prevalence settings, yet little is known about actual integration of HIV with maternal care – or how integrated provision can be improved – in public sector facilities.
- Client flow assessments were conducted over five days in MCH units of eight facilities in Swaziland in 2009, 2010 and 2012 (N=8263 visits tracked) to determine the extent to which HIV/STI services were received with MCH services in the same visit, and in what combinations.
- We also assessed whether these outcomes improved with time in facilities which received an intervention designed to strengthen integration of HIV into post-natal care services (the Integra Initiative).

Key messages

- Some provision of HIV/STI services with MCH care occurred at all facilities, indicating a capacity to integrate services in the public sector, yet relatively few women receive integrated services.
- In three facilities, increases in integration over time were driven by increases in HIV counselling. Sharp declines in other facilities suggest integration is difficult to sustain, given frequent staff rotation and vertical HIV treatment campaigns that can divert resources for integration.

- There was no evidence of an increase in integration in three of four intervention facilities. Impact of the intervention to strengthen integration of HIV into PNC will remain limited until more women attend PNC; the best opportunities for scaling up HIV integration may lie with ANC, child health and family planning, given their frequent use.

Strengths and limitations of this study

- The main strength is the scale and novelty of client flow data in public sector facilities in sub-Saharan Africa, offering detailed combinations of services received in every consultation. Such detail is typically unavailable from routine health information systems.
- An important limitation is the logistical challenge in conducting client flow assessments simultaneously across eight government facilities, affecting comparability of data across facilities and time points.

INTRODUCTION

Maternal mortality and HIV have been described as "intersecting epidemics" which must be simultaneously tackled.[1, 2] In the setting for this study – Swaziland, where more than 40% of pregnant women are infected with HIV – HIV is intimately linked with maternal mortality and hinders efforts to lower maternal death rates.[3, 4]

Since the International Conference on Population and Development in 1994, a strong case has been made for integrating HIV services into sexual and reproductive health (SRH) with potential benefits for both clients and facilities.[5, 6] Integration can simultaneously address clients' reproductive health goals and their needs for HIV prevention and treatment and PMTCT.[7] Process evaluations of integrated HIV and family planning (FP) services indicate that facilities can gain by increasing the provision, uptake and efficiency of services while improving client satisfaction and reducing HIV-related stigma in clinics.[8]

More recently, the case for expanding integration of HIV/AIDS services to maternal, neonatal, child health and nutrition, including family planning, is supported in a systematic review which concludes that integration of such services is feasible to implement under certain circumstances.[9] Furthermore, such integration can yield positive effects on the quality of services as well as client outcomes including contraceptive use, antiretroviral therapy in pregnancy, and HIV testing.[9]

Maternal and child health services can thus serve as entry points for HIV prevention, treatment and care, particularly in contexts of high HIV prevalence. Yet little is known about existing

levels of integration, particularly in public sector health facilities, or how provision can be improved and scaled up.[8]

The Integra Initiative is a large-scale non-randomised evaluation designed to assess different models of SRH-HIV integration, including the integration of HIV/STI services with post-natal care (PNC) in Swaziland. Although not a randomised controlled trial, Integra was registered for good practice and transparency (Current Controlled Trials NCT01694862). The specific models of integration – including the use of post-natal care as an entry point for HIV/STI services in Swaziland – and their hypothesised benefits for clients and health care efficiency are detailed in the Integra study protocol.[10]

As part of the Integra Initiative, this study analysed client flow data collected in eight public sector facilities in Swaziland in 2009, 2010 and 2012, to determine whether clients seeking maternal and child health services (MCH) receive integrated services, and if so, in what combinations of HIV/STI and MCH services.[10] We also sought to understand how the receipt of integrated services differs over time and between facilities which did and did not receive the Integra intervention. We hoped the answers would help identify gaps and opportunities for integrating HIV within maternal health services and achieving universal access to both.

METHODS

Data Collection

As part of Integra's non-randomised design, eight public sector facilities were selected from three of Swaziland's four regions. Four facilities were purposively designated as Intervention facilities (referred to as Facilities A-D), based on their previous participation in an operations

research study by Population Council, one of the Integra institutional partners.[11] Four comparison facilities were selected based on their distance from intervention sites (to avoid contamination) and no current provision of integrated HIV-PNC services (Facilities E-H), as determined by discussions with the Ministry of Health and site visits by Population Council.

In the intervention facilities, between October 2009 and December 2010, Integra delivered a programme designed to strengthen and maintain the provision of integrated HIV and PNC services. The intervention components included: (a) a training package to facilitate mentoring of front-line health providers by more experienced providers; (b) job aids to promote integration, including the Balanced Counselling Strategy Plus (BCS+) toolkit containing an algorithm, counselling cards and brochures to support counselling, including HIV service provision, within PNC consultations;[11, 12] and (c) ongoing support to discuss role clarification, organisational change, referral/linkages and management of service statistics.

The client flow assessments (CFAs) comprise one data component of the Integra evaluation. The CFAs were modelled on the Patient Flow Analysis, a method developed by the Centers for Disease Control in the 1970s to track patients' movements through a clinic over one day,[13, 14] and shown to be effective in measuring intervention effectiveness within the context of usual practice.[15] In this context, CFAs were designed to capture service utilisation patterns among clients seeking MCH services, given that data on integrated service provision were not available from routine clinical data (which collect data on different services in separate registers). Specifically, CFAs were conducted in all study facilities in November 2009, December 2010, and August 2012. Over a period of five days, Monday through Friday, all clients entering

the facility for MCH health services were given a client flow form by teams of trained local researchers or service providers. Clients carried the form throughout their visit, and each service provider they saw completed the form in their consultation room/cubicle, indicating session start/end times, the service(s) received by the client and any referrals to other providers.

The first CFA (late November 2009) was conducted soon after the intervention began in October 2009, but before it was fully implemented in any site. For logistical reasons, the client flow assessments could not be conducted in the same week of each year. And specific circumstances in some facilities meant the assessments could not be simultaneous in all eight sites, as the protocol had intended.

Data analysis

We defined our unit of analysis to be a visit, which comprised all providers seen and services received in the same day for each client, as captured on the client assessment form. Clients were either a single adult or an adult plus a child. We excluded visits of males aged 12 years or over, to focus on maternal and child health services. The age of 12 was selected as reproductive health services were received by females as young as 12.

The following primary and secondary outcomes were calculated for each facility and time point:

1. Receipt of integrated HIV-MCH services: the proportion of all visits in which a client receives any HIV or STI service, specifically: HIV testing, counselling or treatment; PMTCT; or STI counselling or testing

and

any of the following MCH services: FP counselling or provision; PNC for mother or baby; cervical cancer screening; child health (including weighing and immunisations); and antenatal care (ANC).

We hypothesised that HIV-MCH integration would increase in facilities which received the Integra intervention.

2. Receipt of HIV counselling: the proportion of all visits in which a client receives HIV counselling.

   We hypothesised that HIV counselling would increase as a result of the Integra intervention, regardless of women's need for HIV testing or treatment which are not constant (medical histories, including the need for testing or treatment, were not captured on the CFA form).

We also sought to describe which MCH services were most commonly combined with HIV/STI services, by calculating the percentage of visits in which an HIV/STI service was combined with each type of MCH service. We examined the change over time in the proportion of visits receiving integrated HIV/STI and MCH services (primary outcome) and HIV counselling (secondary outcome) separately for each facility. We used the 95% confidence interval around the difference (in the 2010 and 2012 proportions compared to 2009) as an indication of whether the observed change was due to chance (if it included the null value of zero).

To examine differences in the key outcomes by design group, we calculated the risk difference in 2010 and 2012 (each compared to 2009) for intervention versus comparison facilities for both the primary and secondary outcomes using a two-stage approach. In the first stage we

estimated facility-level residuals by fitting a logistic regression model and including terms to adjust for baseline value (corresponding proportion of visits in 2009), average annual client load (<10000, 10000+), and rural/urban status. Difference residuals were then obtained as the difference between the observed and predicted values (divided by facility size). In the second stage we analysed the facility-level residuals, based on the assumption that in the absence of any intervention effect the residuals should be distributed normally with no systematic difference between the intervention and comparison arms. Difference residuals were analysed using linear regression including an interaction term representing the difference in 'change from baseline' between the design groups.

Ethics Statement

Ethics approval for the client flow assessments was obtained from the Swaziland Scientific Review Board, the London School of Hygiene & Tropical Medicine and the Population Council Institutional Review Board.

RESULTS

Across eight facilities, 3261 visits were tracked in November 2009, 2086 visits in December 2010, and 2916 in August 2012. Table 1 presents general characteristics of the visits and facilities. Additional details about each facility are provided in Supplementary Table 1. Overall, about half of the visits included an adult female and child (under 12 years), versus an adult client only, although this proportion varied across facilities (range: 28%-95%). In almost all facilities, clients received on average more than one service during their visit, with many receiving two or more. Each year, approximately eight percent of clients did not receive any

service or referral during their visit, with the highest proportions in the facilities with highest client load (e.g., 18% of clients in Facility B and 31% in Facility D in 2010). In all facilities, and in both years, child health services were either the first or second most common service received. Family planning counselling or provision, and ante-natal care, were among the top three services for most facilities. Across facilities, the least common services received were post-natal care and cervical screening (See Supplementary Table 2).

Table 1. Characteristics of the facilities, visits and services tracked in 2009, 2010 and 2012

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	590	475	532	855	263	408	211	184	241	753	411	607
Client category												
Adult (12+ years) only	395 (66.9%)	196 (41.3%)	211 (39.7%)	443 (51.8%)	153 (58.2%)	172 (42.2%)	144 (68.2%)	87 (47.3%)	82 (34%)	310 (41.2%)	197 (47.9%)	408 (67.2%)
Adult + child	176 (29.8%)	278 (58.5%)	320 (60.2%)	153 (17.9%)	109 (41.4%)	236 (57.8%)	64 (30.3%)	97 (52.7%)	156 (64.7%)	93 (12.4%)	213 (51.8%)	198 (32.6%)
Adult age												
Mean [sd]	26.2 [6.4]	26.2 [7.2]	26.3 [6.5]	26.8 [8.2]	27 [7.2]	26.6 [7.3]	28.5 [8.4]	26.8 [8]	27.7 [8.5]	27.6 [7.4]	27.3 [8.4]	31.3 [10.2]
Missing	9 (1.5%)	258 (54.3%)	17 (3.2%)	357 (41.8%)	40 (15.2%)	13 (3.2%)	2 (.9%)	2 (1.1%)	1 (.4%)	382 (50.7%)	165 (40.1%)	12 (2%)
Services received per visit												
None	37 (6.3%)	24 (5.1%)	88 (16.5%)	134 (15.7%)	47 (17.9%)	23 (5.6%)	11 (5.2%)	6 (3.3%)	32 (13.3%)	93 (12.4%)	129 (31.4%)	29 (4.8%)
One	319 (54.1%)	106 (22.3%)	192 (36.1%)	479 (56%)	145 (55.1%)	208 (51%)	47 (22.3%)	57 (31%)	114 (47.3%)	246 (32.7%)	135 (32.8%)	238 (39.2%)
Two or more	234 (39.7%)	345 (72.6%)	252 (47.4%)	242 (28.3%)	71 (27%)	177 (43.4%)	153 (72.5%)	121 (65.8%)	95 (39.4%)	414 (55%)	147 (35.8%)	340 (56%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.3]	2.5 [1.4]	2.6 [2]	1.6 [1.1]	1.4 [.8]	2 [1.6]	2.6 [1.7]	2 [1]	1.9 [1.3]	2.1 [1.2]	2 [1.3]	2 [1.3]
Mean [sd] providers seen	1.3 [.5]	1.5 [.5]	1.6 [.9]	1.2 [.4]	1 [.2]	1.4 [.7]	1.3 [.5]	1.1 [.4]	1.3 [.5]	1.5 [.7]	1.5 [.7]	1.1 [.3]
Visits where no services were either referred or received	36 (6.1%)	22 (4.6%)	88 (16.5%)	112 (13.1%)	47 (17.9%)	15 (3.7%)	7 (3.3%)	6 (3.3%)	16 (6.6%)	81 (10.8%)	69 (16.8%)	29 (4.8%)
Average annual client load*		32,321			65,794			9,974			40,485	
Setting (urban/rural)		Urban			Urban			Peri-urban			Urban	

Comparison	Facility E			Facility F			Facility G			Facility H		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	220	215	380	317	333	347	146	170	114	169	35	287
Client category												
Adult (12+ years) only	131 (59.5%)	72 (33.5%)	234 (61.6%)	194 (61.2%)	183 (55%)	154 (44.4%)	74 (50.7%)	106 (62.4%)	47 (41.2%)	110 (65.1%)	2 (5.7%)	178 (62%)
Adult + child	78 (35.5%)	143 (66.5%)	145 (38.2%)	117 (36.9%)	150 (45%)	193 (55.6%)	69 (47.3%)	64 (37.6%)	67 (58.8%)	48 (28.4%)	33 (94.3%)	107 (37.3%)
Adult age												
Mean [sd]	26 [7.5]	26 [5.9]	34.5 [12.6]	26.1 [6.2]	26.4 [6.3]	26.5 [7.4]	27.4 [7.8]	31.4 [10.8]	26.5 [7.2]	25.1 [6]	29.5 [10.6]	30.9 [11.9]
Missing	1 (.5%)	95 (44.2%)	53 (13.9%)	5 (1.6%)	124 (37.2%)	9 (2.6%)	0 (0%)	6 (3.5%)	5 (4.4%)	0 (0%)	33 (94.3%)	67 (23.3%)
Services received per visit												
None	10 (4.5%)	3 (1.4%)	13 (3.4%)	1 (.3%)	5 (1.5%)	8 (2.3%)	11 (7.5%)	6 (3.5%)	14 (12.3%)	31 (18.3%)	0 (0%)	29 (10.1%)
One	99 (45%)	34 (15.8%)	45 (11.8%)	100 (31.5%)	177 (53.2%)	46 (13.3%)	19 (13%)	84 (49.4%)	32 (28.1%)	32 (18.9%)	8 (22.9%)	155 (54%)
Two or more	111 (50.5%)	178 (82.8%)	322 (84.7%)	216 (68.1%)	151 (45.3%)	293 (84.4%)	116 (79.5%)	80 (47.1%)	68 (59.6%)	106 (62.7%)	27 (77.1%)	103 (35.9%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.1]	2.4 [1.1]	3.2 [1.6]	2.3 [1.6]	1.6 [.9]	3.4 [1.6]	3.2 [1.6]	1.6 [.6]	2.6 [1.6]	2.7 [1.6]	2.8 [1.3]	1.8 [1.5]
Mean [sd] providers seen	1.3 [.5]	1.1 [.2]	1.7 [.7]	1.8 [.8]	1 [.2]	1.3 [.6]	1.5 [.5]	1.4 [.6]	1.3 [.6]	1.4 [.6]	1.1 [.3]	1.2 [.5]
Visits where no services were either referred or received	9 (4.1%)	2 (.9%)	12 (3.2%)	1 (.3%)	5 (1.5%)	7 (2%)	11 (7.5%)	5 (2.9%)	8 (7%)	3 (1.8%)	0 (0%)	21 (7.3%)
Average annual client load*		7,736			28,202			9,674			6,959	
Setting (urban/rural)		Rural			Peri-urban			Rural			Rural	

*Annual client load taken from health facility assessments conducted for the Integra Initiative in 2010. All tables are N (%) unless indicated otherwise.

Receipt of integrated HIV-MCH services

There was evidence of HIV-MCH integration at all facilities and time points, although the extent of integration (the proportion of visits in which integrated HIV-MCH services were received) varied by facility: specifically, between 9% and 49% in 2009, 2%-22% in 2010 and 10-44% in 2012 (see Table 2). In the short-term, five facilities experienced declines in integration between 2009 and 2010: by seven and 13 percentage points in two intervention facilities; and by 12, 19 and 48 percentage points in three comparison facilities. In the longer-term, integration increased in one intervention site (Facility A, from 9% in 2009 to 17% of visits in 2012) and two comparison facilities (Facility E, from 11% to 37%; and Facility F, from 16% to 44% in 2012, after experiencing an initial drop to 9% in 2010). Meanwhile, integration fell in one intervention site (Facility C, from 33% to 16%) and two comparison facilities (Facility G, from 49% to 27%; Facility H, from 25% to 14%). Two intervention facilities (B and D) experienced no significant change in HIV-MCH integration between 2009 and 2012.

Table 2. Proportion of visits receiving the primary and secondary outcomes, by facility, year and design group

	Intervention									
	Facility A		Facility B		Facility C		Facility D		All intervention facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	54/590 (9.2%)		83/855 (9.7%)		69/211 (32.7%)		98/753 (13%)		16.1%	
2010	74/475 (15.6%)	6.4% (2.4, 10.4)	6/263 (2.3%)	-7.4% (-10.1, -4.7)	38/184 (20.7%)	-12% (-20.7, -3.4)	73/411 (17.8%)	4.7% (.3, 9.2)	14.1%	-0.8% (-19.3, 17.7)
2012	91/532 (17.1%)	8% (4, 11.9)	40/408 (9.8%)	.1% (-3.4, 3.6)	38/241 (15.8%)	-16.9% (-24.8, -9.1)	78/607 (12.9%)	-.2% (-3.8, 3.4)	13.9%	-8.1% (-27.0, 10.8)
Outcome 2: HIV counselling received										
2009	38/590 (6.4%)		38/855 (4.4%)		56/211 (26.5%)		24/753 (3.2%)		10.2%	
2010	72/475 (15.2%)	8.7% (4.9, 12.5)	20/263 (7.6%)	3.2% (-.3, 6.6)	30/184 (16.3%)	-10.2% (-18.2, -2.2)	54/411 (13.1%)	10% (6.5, 13.5)	13.1%	0.1% (-13.0, 13.2)
2012	81/532 (15.2%)	8.8% (5.1, 12.4)	13/408 (3.2%)	-1.3% (-3.5, .9)	21/241 (8.7%)	-17.8% (-24.8, -10.9	53/607 (8.7%)	5.5% (3, 8.1)	9.0%	-11% (-32.6, 10.6)
	Comparison									
	Facility E		Facility F		Facility G		Facility H		All comparison facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	24/220 (10.9%)		52/317 (16.4%)		72/146 (49.3%)		42/169 (24.9%)		25.4%	
2010	57/215 (26.5%)	15.6% (8.4, 22.8)	30/333 (9%)	-7.4% (-12.5, -2.3)	6/170 (3.5%)	-45.8% (-54.4, -37.2	5/35 (14.3%)	-10.6% (-23.9, 2.7)	13.3%	-10.8% (-29.2, 7.7)
2012	141/380 (37.1%)	26.2% (19.8, 32.6)	154/347 (44.4%)	28% (21.3, 34.6)	31/114 (27.2%)	-22.1% (-33.6, -10.6	39/287 (13.6%)	-11.3% (-18.9, -3.6)	30.6%	0.6% (-19.5, 18.2)
Outcome 2: HIV counselling received										
2009	10/220 (4.5%)		27/317 (8.5%)		44/146 (30.1%)		24/169 (14.2%)		14.4%	
2010	29/215 (13.5%)	8.9% (3.6, 14.3)	13/333 (3.9%)	-4.6% (-8.3, -.9)	4/170 (2.4%)	-27.8% (-35.6, -20)	3/35 (8.6%)	-5.6% (-16.3, 5)	7.1%	-10.1% (-23.1, 3.0)
2012	114/380 (30%)	25.5% (20.1, 30.8)	202/347 (58.2%)	49.7% (43.7, 55.7)	18/114 (15.8%)	-14.3% (-24.4, -4.3)	18/287 (6.3%)	-7.9% (-13.9, -2)	27.6%	3.4% (-18.2, 25.0)

†Unadjusted cluster-level proportions analysed separately at each time point. ‡Change from baseline adjusted for facility size and rural/urban status. All confidence intervals are at 95% confidence level.

Combinations of HIV/STI and MCH services received

In 2009, at least one client in every facility received each type of HIV-MCH integration investigated; that is, one or more clients received integration of HIV-FP (provision and counselling), HIV-ANC, HIV-PNC (for mother or baby), HIV-cervical screening (HIV-CS), and HIV-child health (HIV-CH). Figure 1 shows the proportion of visits in which each service combination was received at each facility. The most common integration in 2009 was HIV with child health services (up to 33% of all visits in Facility G), followed by HIV-ANC and HIV-FP (counselling or provision). Less frequent was integration of HIV services with PNC (a maximum of 6% of visits in Facility C) or cervical screening (maximum 6% of visits in Facility D).

In 2010, integration of HIV services with the MCH services no longer occurred in every facility. For example, in three facilities there were zero visits in which integration of HIV services and family planning occurred; in one intervention and all comparison facilities there was no integration of HIV services and cervical screening services; and in two comparison sites, there were no cases of HIV-ANC and HIV-PNC integration . Excluding the latter two sites, integration of HIV-ANC was the most common type of integration in 2010. Between 2009 and 2012, HIV integration with FP counselling rose in facilities A, E and F - the same facilities that experienced increases in overall HIV-MCH integration. HIV-FP counselling integration declined in the other facilities, and integration of HIV and PNC services – the focus of the intervention – remained low in all facilities over time.

Receipt of HIV counselling

As a secondary outcome, we hypothesised that HIV counselling would increase in the intervention facilities. Table 2 shows that the proportion of visits in which a client received HIV counselling increased between 2009 and 2012 in two intervention (A,D) and two comparison facilities (E,F), and declined in two intervention sites (Facility C) and two comparison sites (G,H). The absolute numbers of visits that included HIV counselling are presented in Figure 2, which also shows that HIV counselling was more often provided in combination with an MCH service than alone. Specifically, HIV counselling was most often provided together with ANC, FP counselling or child health services (data not shown).

Evidence of an intervention effect

As shown in Table 2 (final column), there was no statistical evidence that integration increased over time in intervention facilities as a group. On average, the intervention facilities provided integrated services in 16 percent of visits in 2009 and 14 percent in both 2010 and 2012. Nor was there statistical evidence that the proportion of visits providing HIV counselling increased in the intervention group (averaging 10% in 2009 and 9% in 2012). In the comparison group, both overall HIV-MCH integration and HIV counselling increased between 2009 and 2012 (by 5 and 13 percentage points) after experiencing a decline in 2010. For these differences, 95% confidence intervals include the null value of zero. Between the intervention and comparison groups, there was no statistical difference in change from baseline levels of HIV-MCH integration or provision of HIV counselling (data not shown).

DISCUSSION

With what we believe are among the most detailed data on HIV-MCH integration in the public sector in Africa, we have been able to assess the extent to which clients are receiving integrated services, and in which combinations over time. The client flow assessments have shown that HIV/STI services (counselling, testing and treatment) are being integrated with a wide range of MCH services, including family planning, ante-natal care, post-natal care, cervical screening and child health services. This is evidence of the capacity to integrate, in large urban facilities as well as small, rural facilities across Swaziland. It also fills a current gap in evidence – regarding the feasibility of integrating HIV services with infant/child health services, and postnatal/postpartum services. A recent systematic review of integration evaluations identified both models as 'inadequately studied' to date.[9]

Nevertheless, integration occurred in a minority of visits and varied considerably across facilities. Furthermore, the level of integration fell in three of the eight facilities between 2009 and 2012. The facility with the highest level of integration in 2009 dropped to the lowest a year later (from 49% to <2%). This may be explained by the existence of an NGO campaign to increase access to ART in the area of that facility during the 2010 assessment, as HIV treatment appears to have displaced almost all other HIV and MCH services. This suggests that integration can be susceptible to vertical programmes or competing priorities, particularly in smaller facilities where the 2010 declines in integration were steepest.

It is also possible that integration declined in settings where clients did not need HIV services with every visit. The CFA did not capture clients' history or need for such services, and thus we

cannot interpret observed changes in their provision. For this reason we were particularly interested in the provision of HIV counselling, which can be promoted regardless of need for testing or treatment. HIV counselling rose in two intervention and two comparison facilities. In the three sites where HIV-MCH integration rose, this appeared to be driven by an increase in HIV counselling. That HIV counselling was most often provided with an MCH service rather than alone suggests it has arole to play in scaling up integration, but requires a concerted effort to sustain its provision.

The most common form of integration observed was between HIV services and child health, followed by ANC and FP. These services may offer the best opportunities for integration with HIV, given most women attended for child health, ANC and FP services. This is particularly encouraging in light of a recent review concluding that uptake of PMTCT in sub-Saharan Africa is inadequate, but improves with an integrated family-centred approach, for example, if HIV treatment is provided at antenatal clinics.[7]

Less common was integration of HIV/STI with PNC or cervical screening, most likely due to the lower number of clients receiving PNC and cervical screening relative to other services (or PNC clients may have received HIV/STI testing in recent ANC visits). This suggests that potential effectiveness of the Integra Initiative – which focuses on HIV-PNC integration in Swaziland – may be limited until more clients attend for PNC services. And this may require further investment in equipment and training for PNC (as well as cervical screening, as only one facility had the capacity to offer immediate cryotherapy) as well as demand creation to increase service uptake.

The formal comparison of integration by study design (intervention versus comparison sites) showed no statistical difference in HIV-MCH integration over time. Neither was there a meaningful difference in the receipt of HIV counselling in the intervention group over time.

Limitations and the challenges of embedding research in 'real-world' settings

The observed changes in levels of integration, and absence of an intervention effect, could be due to a number of factors which we were unable to account for given the non-randomised design, as well as challenges implementing the protocol as intended.

With regard to design: in a small country with limited number of facilities, intervention sites could not be matched with similar-sized comparison facilities. This resulted in systematically different groups, with intervention facilities primarily large and urban, and comparison facilities mostly small and rural. Given the resulting heterogeneity, and the focus on a facility-specific outcome in this analysis, we felt it was more informative to compare changes by facility than study design. The wide variation we observed across facilities likely reflects the different capacities and infrastructure available to provide integrated services, i.e., facilities can not follow the same 'blue print' for integration, particularly given the variability in facility size, client volumes and staffing levels among the eight study facilities. Detailed case studies are underway to explore the role of facility differences in greater depth, including intervention dose and quality, as well as contextual information, to enhance interpretation of the levels and patterns of integration revealed by the client flow assessments.

Some observed changes may also be due to 'seasonal' differences in 2009 and 2010. Coordinating client flow assessments across eight facilities proved logistically challenging and synchronicity was not always achieved as intended. In 2010, most assessments were delayed until the week before Christmas (as compared to November 2009) which may account for the smaller number of clients in most facilities in 2010. This timing may have affected the range of services provided and may account for different patterns of integration. Smaller, rural facilities – where the drops in integration were the steepest - may be impacted more than large, rural sites during such holiday periods.

It is also possible that provision of HIV and MCH services may fluctuate frequently or periodically, in patterns we could not detect from 5-day 'snapshot' assessments (regardless of their specific timing). An early evaluation of CDC's 'patient flow analysis' method, conducted over one day in family planning clinics in Kenya, concluded that: "the 'typical' clinic day does not really exist. The client/patient load and staffing patterns are likely to vary according to many factors: by day of the week, or season of the year, staff vacation or sickness, etc."[14] Assessments were extended to five days in this study, yet, neither does the 'typical' clinic week exist. It may be more informative to monitor over a longer period, for more representative data. However, the 5-day assessments proved challenging and resource-intensive to implement, and longer versions may be prohibitive in many settings. Previous evaluations of patient flow analyses also note that data may not be representative since staff – aware of the assessment – may try to perform at their best.[14] For these reasons, strengthening routine data collection systems may be preferable, but many existing systems record services individually in

separate registers, and are thus unable to document service integration without fundamentally changing the system. It was this barrier that led us to utilise the client flow assessment.

Conclusions

The client flow assessment provided rich detail about the range and combinations of services received by large number of clients. This was valuable for understanding whether and how HIV and MCH services are integrated in practice. The data confirm that, in a context of high HIV prevalence, capacity exists in public sector services for integration of HIV services into MCH care. In particular, ANC, child health and family planning provide promising entry-points for reaching the largest number of women. Sustaining HIV-MCH integration may require concerted effort over time. The study limitations reflect the challenges of embedding rigorous research into existing and diverse facilities (i.e., 'real-world' evaluations), and difficulties in recording the provision of integrated services.

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Author contributions

SM, JK, CW, KC, RN helped to design the data collection. JK managed the data collection. JF and WZ cleaned and managed the datasets. IB and JF led the analysis. All authors provided input into the data interpretation. IB drafted the manuscript. All authors read and commented on a complete draft.

Data sharing

The dataset will be made available via an LSHTM repository upon completion of the Integra Initiative.

Competing interests statement

The authors have declared that no competing interests exist.

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Title

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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ABSTRACT

Objective

Maternal and child health (MCH) care may provide an entry point for HIV services in high HIV-prevalence settings. Our objective was to assess integration of HIV with MCH services in public sector facilities in Swaziland.

Design

In 2009, 2010 and 2012, client flow assessments were conducted over five days in the MCH units of eight government facilities, purposively selected as intervention or comparison sites.

Participants

8263 MCH visits with female clients were tracked: 3261 in 2009; 2086 in 2010; and 2916 in 2012.

Intervention

Activities and resources to strengthen integration of HIV services into post-natal care, 2009 - 2010.

Main outcome measures

(1) The proportion of all visits in which an HIV/STI testing, counselling or treatment was received together with an MCH service;

(2) The proportion of all visits in which a client receives HIV counselling.

Results

Across facilities, the proportion of visits in which both HIV/STI and MCH services were received varied considerably, e.g., from 9%-49% in 2009. HIV/STI services were integrated most frequently with child health, ante-natal care (ANC) and family planning – the most common reasons for women's attendance – and least often with post-natal care (PNC) and cervical screening. There was no meaningful difference in integration over time by design group, and considerable heterogeneity across facilities. Receipt of integrated services increased in one intervention and two comparison facilities, where HIV counseling also rose, and fell in one intervention and two comparison facilities.

Conclusions

Provision of HIV/STI services with MCH care occurred at all facilities, yet relatively few women receive integrated services. Increases in integration were driven by increases in HIV counseling while sharp declines in some facilities indicate integration is difficult to sustain. Opportunities for intensifying HIV integration lie with ANC, child health and family planning, while HIV-PNC integration will remain limited until more women attend PNC.

Trial registry and number

Current Controlled Trials NCT01694862

ARTICLE SUMMARY

Article focus

- Maternal health care may provide an entry point for HIV services in high HIV-prevalence settings, yet little is known about actual integration of HIV with maternal care – or how integrated provision can be improved – in public sector facilities.
- Client flow assessments were conducted over five days in MCH units of eight facilities in Swaziland in 2009, 2010 and 2012 (N=8263 visits tracked) to determine the extent to which HIV/STI services were received with MCH services in the same visit, and in what combinations.
- We also assessed whether these outcomes improved with time in facilities which received an intervention designed to strengthen integration of HIV into post-natal care services (the Integra Initiative).

Key messages

- Some provision of HIV/STI services with MCH care occurred at all facilities, indicating a capacity to integrate services in the public sector, yet relatively few women receive integrated services.
- In three facilities, increases in integration over time were driven by increases in HIV counselling. Sharp declines in other facilities suggest integration is difficult to sustain, given frequent staff rotation and vertical HIV treatment campaigns that can divert resources for integration.

- There was no evidence of an increase in integration in three of four intervention facilities. Impact of the intervention to strengthen integration of HIV into PNC will remain limited until more women attend PNC; the best opportunities for scaling up HIV integration may lie with ANC, child health and family planning, given their frequent use.

Strengths and limitations of this study

- The main strength is the scale and novelty of client flow data in public sector facilities in sub-Saharan Africa, offering detailed combinations of services received in every consultation. Such detail is typically unavailable from routine health information systems.
- An important limitation is the logistical challenge in conducting client flow assessments simultaneously across eight government facilities, affecting comparability of data across facilities and time points.

INTRODUCTION

Maternal mortality and HIV have been described as "intersecting epidemics" which must be simultaneously tackled.[1, 2] In the setting for this study – Swaziland, where more than 40% of pregnant women are infected with HIV – HIV is intimately linked with maternal mortality and hindersing efforts to lower maternal death rates.[3, 4]

Since the International Conference on Population and Development in 1994, a strong case has been made for integrating HIV services into sexual and reproductive health (SRH) with potential benefits for both clients and facilities.[5, 6] Integration can simultaneously address clients' reproductive health goals and their needs for HIV prevention and treatment and PMTCT.[7] Process evaluations of integrated HIV and family planning (FP) services indicate that facilities can gain by increasing the provision, uptake and efficiency of services while improving client satisfaction and reducing HIV-related stigma in clinics.[8]

More recently, the case for expanding integration of HIV/AIDS services to maternal, neonatal, child health and nutrition, including family planning, is supported in a systematic review which concludes that integration of such services is feasible to implement under certain circumstances.[9] Furthermore, such integration can yield positive effects on the quality of services as well as client outcomes including contraceptive use, antiretroviral therapy in pregnancy, and HIV testing.[9]

Maternal and child health services can thus serve as entry points for HIV prevention, treatment and care, particularly in contexts of high HIV prevalence. Yet little is known about existing

levels of integration, particularly in public sector health facilities, or how provision can be improved and scaled up.[8]

The Integra Initiative is a large-scale non-randomised evaluation ~~was~~ designed to assess ~~evaluate~~ different models of SRH-HIV integration, including the integration of HIV/STI services with post-natal care (PNC) in Swaziland.[~~10~~] Although not a randomised controlled trial, Integra was registered for good practice and transparency (Current Controlled Trials NCT01694862). The specific models of integration – including the use of post-natal care as an entry point for HIV/STI services in Swaziland – and their hypothesised benefits for clients and health care efficiency are detailed in the Integra study protocol.[10]

As part of the Integra Initiative, this study analysed client flow data collected in eight public sector facilities in Swaziland in 2009, 2010 and 2012, to determine whether clients seeking maternal and child health services (MCH) receive integrated services, and if so, in what combinations of HIV/STI and MCH services.[10] We also sought to understand how the receipt of integrated services differs over time and between facilities which did and did not receive the Integra intervention. We hoped the answers would help identify gaps and opportunities for integrating HIV within maternal health services and achieving universal access to both.

METHODS

Data Collection

As part of Integra's non-randomised design, eight public sector facilities were selected from three of Swaziland's four regions. Four facilities were purposively designated as Intervention facilities (referred to as Facilities A-D), based on their previous participation in an operations

research study by Population Council, one of the Integra institutional partners.[11] Four comparison facilities were selected based on their distance from intervention sites (to avoid contamination) and no current provision of integrated HIV-PNC services (Facilities E-H), as determined by discussions with the Ministry of Health and site visits by Population Council.

In the intervention facilities, between October 2009 and December 2010, Integra delivered a programme designed to strengthen and maintain the provision of integrated HIV and PNC services. The intervention components included: (a) a training package to facilitate mentoring of front-line health providers by more experienced providers; (b) job aids to promote integration, including the Balanced Counselling Strategy Plus (BCS+) toolkit containing an algorithm, counselling cards and brochures to support counselling, including HIV service provision, within PNC consultations;[11, 12] and (c) ongoing support to discuss role clarification, organisational change, referral/linkages and management of service statistics.

The client flow assessments (CFAs) comprise one data component of the Integra evaluation. The CFAs were modelled on the Patient Flow Analysis, a method developed by the Centers for Disease Control in the 1970s to track patients' movements through a clinic over one day,[13, 14] and shown to be effective in measuring intervention effectiveness within the context of usual practice.[15] In this context, CFAs were designed to capture service utilisation patterns among clients seeking MCH services, given that data on integrated service provision were not available from routine clinical data (which collect data on different services in separate registers). Specifically, CFAs were conducted in all study facilities in November 2009, December 2010, and August 2012. Over a period of five days, Monday through Friday, all clients entering

the facility for MCH health services were given a client flow form by teams of trained local researchers or service providers. Clients carried the form throughout their visit, and each service provider they saw completed the form in their consultation room/cubicle, indicating session start/end times, the service(s) received by the client and any referrals to other providers.

The first CFA (late November 2009) was conducted soon after the intervention began in October 2009, but before it was fully implemented in any site. For logistical reasons, the client flow assessments could not be conducted in the same week of each year. And specific circumstances in some facilities meant the assessments could not be simultaneous in all eight sites, as the protocol had intended.

Data analysis

We defined our unit of analysis to be a visit, which comprised all providers seen and services received in the same day for each client, as captured on the client assessment form. Clients were either a single adult or an adult plus a child. We excluded visits of males aged 12 years or over, to focus on maternal and child health services. The age of 12 was selected as reproductive health services were received by females as young as 12.

The following primary and secondary outcomes were calculated for each facility and time point:

1. Receipt of integrated HIV-MCH services: the proportion of all visits in which a client receives any HIV or STI service, specifically: HIV testing, counselling or treatment; PMTCT; or STI counselling or testing

and

any of the following MCH services: FP counselling or provision; PNC for mother or baby; cervical cancer screening; child health (including weighing and immunisations); and antenatal care (ANC).

We hypothesised that HIV-MCH integration would increase in facilities which received the Integra intervention.

2. Receipt of HIV counselling: the proportion of all visits in which a client receives HIV counselling.

   We hypothesised that HIV counselling would increase as a result of the Integra intervention, regardless of women's need for HIV testing or treatment which are not constant (medical histories, including the need for testing or treatment, were not captured on the CFA form).

We also sought to describe which MCH services were most commonly combined with HIV/STI services, by calculating the percentage of visits in which an HIV/STI service was combined with each type of MCH service. We examined the change over time in the proportion of visits receiving integrated HIV/STI and MCH services (primary outcome) and HIV counselling (secondary outcome) separately for each facility. We used the 95% confidence interval around the difference (in the 2010 and 2012 proportions compared to 2009) as an indication of whether the observed change was due to chance (if it included the null value of zero).

To examine differences in the key outcomes by design group, we calculated the risk difference in 2010 and 2012 (each compared to 2009) for intervention versus comparison facilities for both the primary and secondary outcomes using a two-stage approach. In the first stage we

estimated facility-level residuals by fitting a logistic regression model and including terms to adjust for baseline value (corresponding proportion of visits in 2009), average annual client load (<10000, 10000+), and rural/urban status. Difference residuals were then obtained as the difference between the observed and predicted values (divided by facility size). In the second stage we analysed the facility-level residuals, based on the assumption that in the absence of any intervention effect the residuals should be distributed normally with no systematic difference between the intervention and comparison arms. Difference residuals were analysed using linear regression including an interaction term representing the difference in 'change from baseline' between the design groups.

Ethics Statement

Ethics approval for the client flow assessments was obtained from the Swaziland Scientific Review Board, the London School of Hygiene & Tropical Medicine and the Population Council Institutional Review Board.

RESULTS

Across eight facilities, 3261 visits were tracked in November 2009, 2086 visits in December 2010, and 2916 in August 2012. Table 1 presents general characteristics of the visits and facilities. Additional details about each facility are provided in Supplementary Table 1. Overall, about half of the visits included an adult female and child (under 12 years), versus an adult client only, although this proportion varied across facilities (range: 28%-95%). In almost all facilities, clients received on average more than one service during their visit, with many receiving two or more. Each year, approximately eight percent of clients did not receive any

service or referral during their visit, with the highest proportions in the facilities with highest client load (e.g., 18% of clients in Facility B and 31% in Facility D in 2010). In all facilities, and in both years, child health services were either the first or second most common service received. Family planning counselling or provision, and ante-natal care, were among the top three services for most facilities. Across facilities, the least common services received were post-natal care and cervical screening (See Supplementary Table 2~~1~~).

Table 1. Characteristics of the facilities, visits and services tracked in 2009, 2010 and 2012

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	590	475	532	855	263	408	211	184	241	753	411	607
Client category												
Adult (12+ years) only	395 (66.9%)	196 (41.3%)	211 (39.7%)	443 (51.8%)	153 (58.2%)	172 (42.2%)	144 (68.2%)	87 (47.3%)	82 (34%)	310 (41.2%)	197 (47.9%)	408 (67.2%)
Adult + child	176 (29.8%)	278 (58.5%)	320 (60.2%)	153 (17.9%)	109 (41.4%)	236 (57.8%)	64 (30.3%)	97 (52.7%)	156 (64.7%)	93 (12.4%)	213 (51.8%)	198 (32.6%)
Adult age												
Mean [sd]	26.2 [6.4]	26.2 [7.2]	26.3 [6.5]	26.8 [8.2]	27 [7.2]	26.6 [7.3]	28.5 [8.4]	26.8 [8]	27.7 [8.5]	27.6 [7.4]	27.3 [8.4]	31.3 [10.2]
Missing	9 (1.5%)	258 (54.3%)	17 (3.2%)	357 (41.8%)	40 (15.2%)	13 (3.2%)	2 (.9%)	2 (1.1%)	1 (.4%)	382 (50.7%)	165 (40.1%)	12 (2%)
Services received per visit												
None	37 (6.3%)	24 (5.1%)	88 (16.5%)	134 (15.7%)	47 (17.9%)	23 (5.6%)	11 (5.2%)	6 (3.3%)	32 (13.3%)	93 (12.4%)	129 (31.4%)	29 (4.8%)
One	319 (54.1%)	106 (22.3%)	192 (36.1%)	479 (56%)	145 (55.1%)	208 (51%)	47 (22.3%)	57 (31%)	114 (47.3%)	246 (32.7%)	135 (32.8%)	238 (39.2%)
Two or more	234 (39.7%)	345 (72.6%)	252 (47.4%)	242 (28.3%)	71 (27%)	177 (43.4%)	153 (72.5%)	121 (65.8%)	95 (39.4%)	414 (55%)	147 (35.8%)	340 (56%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.3]	2.5 [1.4]	2.6 [2]	1.6 [1.1]	1.4 [.8]	2 [1.6]	2.6 [1.7]	2 [1]	1.9 [1.3]	2.1 [1.2]	2 [1.3]	2 [1.3]
Mean [sd] providers seen	1.3 [.5]	1.5 [.5]	1.6 [.9]	1.2 [.4]	1 [.2]	1.4 [.7]	1.3 [.5]	1.1 [.4]	1.3 [.5]	1.5 [.7]	1.5 [.7]	1.1 [.3]
Visits where no services were either referred or received	36 (6.1%)	22 (4.6%)	88 (16.5%)	112 (13.1%)	47 (17.9%)	15 (3.7%)	7 (3.3%)	6 (3.3%)	16 (6.6%)	81 (10.8%)	69 (16.8%)	29 (4.8%)
Average annual client load*		32,321			65,794			9,974			40,485	
Setting (urban/rural)		Urban			Urban			Peri-urban			Urban	

Comparison	Facility E			Facility F			Facility G			Facility H		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	220	215	380	317	333	347	146	170	114	169	35	287
Client category												
Adult (12+ years) only	131 (59.5%)	72 (33.5%)	234 (61.6%)	194 (61.2%)	183 (55%)	154 (44.4%)	74 (50.7%)	106 (62.4%)	47 (41.2%)	110 (65.1%)	2 (5.7%)	178 (62%)
Adult + child	78 (35.5%)	143 (66.5%)	145 (38.2%)	117 (36.9%)	150 (45%)	193 (55.6%)	69 (47.3%)	64 (37.6%)	67 (58.8%)	48 (28.4%)	33 (94.3%)	107 (37.3%)
Adult age												
Mean [sd]	26 [7.5]	26 [5.9]	34.5 [12.6]	26.1 [6.2]	26.4 [6.3]	26.5 [7.4]	27.4 [7.8]	31.4 [10.8]	26.5 [7.2]	25.1 [6]	29.5 [10.6]	30.9 [11.9]
Missing	1 (.5%)	95 (44.2%)	53 (13.9%)	5 (1.6%)	124 (37.2%)	9 (2.6%)	0 (0%)	6 (3.5%)	5 (4.4%)	0 (0%)	33 (94.3%)	67 (23.3%)
Services received per visit												
None	10 (4.5%)	3 (1.4%)	13 (3.4%)	1 (.3%)	5 (1.5%)	8 (2.3%)	11 (7.5%)	6 (3.5%)	14 (12.3%)	31 (18.3%)	0 (0%)	29 (10.1%)
One	99 (45%)	34 (15.8%)	45 (11.8%)	100 (31.5%)	177 (53.2%)	46 (13.3%)	19 (13%)	84 (49.4%)	32 (28.1%)	32 (18.9%)	8 (22.9%)	155 (54%)
Two or more	111 (50.5%)	178 (82.8%)	322 (84.7%)	216 (68.1%)	151 (45.3%)	293 (84.4%)	116 (79.5%)	80 (47.1%)	68 (59.6%)	106 (62.7%)	27 (77.1%)	103 (35.9%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.1]	2.4 [1.1]	3.2 [1.6]	2.3 [1.6]	1.6 [.9]	3.4 [1.6]	3.2 [1.6]	1.6 [.6]	2.6 [1.6]	2.7 [1.6]	2.8 [1.3]	1.8 [1.5]
Mean [sd] providers seen	1.3 [.5]	1.1 [.2]	1.7 [.7]	1.8 [.8]	1 [.2]	1.3 [.6]	1.5 [.5]	1.4 [.6]	1.3 [.6]	1.4 [.6]	1.1 [.3]	1.2 [.5]
Visits where no services were either referred or received	9 (4.1%)	2 (.9%)	12 (3.2%)	1 (.3%)	5 (1.5%)	7 (2%)	11 (7.5%)	5 (2.9%)	8 (7%)	3 (1.8%)	0 (0%)	21 (7.3%)
Average annual client load*		7,736			28,202			9,674			6,959	
Setting (urban/rural)		Rural			Peri-urban			Rural			Rural	

*Annual client load taken from health facility assessments conducted for the Integra Initiative in 2010. All tables are N (%) unless indicated otherwise.

Receipt of integrated HIV-MCH services

There was evidence of HIV-MCH integration at all facilities and time points, although the extent of integration (the proportion of visits in which integrated HIV-MCH services were received) varied by facility: specifically, between 9% and 49% in 2009, 2%-22% in 2010 and 10-44% in 2012 (see Table 2). In the short-term, five facilities experienced declines in integration between 2009 and 2010: by seven and 13 percentage points in two intervention facilities; and by 12, 19 and 48 percentage points in three comparison facilities. In the longer-term, integration increased in one intervention site (Facility A, from 9% in 2009 to 17% of visits in 2012) and two comparison facilities (Facility E, from 11% to 37%; and Facility F, from 16% to 44% in 2012, after experiencing an initial drop to 9% in 2010). Meanwhile, integration fell in one intervention site (Facility C, from 33% to 16%) and two comparison facilities (Facility G, from 49% to 27%; Facility H, from 25% to 14%). Two intervention facilities (B and D) experienced no significant change in HIV-MCH integration between 2009 and 2012.

Table 2. Proportion of visits receiving the primary and secondary outcomes, by facility, year and design group

	Intervention									
	Facility A		Facility B		Facility C		Facility D		All intervention facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	54/590 (9.2%)		83/855 (9.7%)		69/211 (32.7%)		98/753 (13%)		16.1%	
2010	74/475 (15.6%)	6.4% (2.4, 10.4)	6/263 (2.3%)	-7.4% (-10.1, -4.7)	38/184 (20.7%)	-12% (-20.7, -3.4)	73/411 (17.8%)	4.7% (.3, 9.2)	14.1%	-0.8% (-19.3, 17.7)
2012	91/532 (17.1%)	8% (4, 11.9)	40/408 (9.8%)	.1% (-3.4, 3.6)	38/241 (15.8%)	-16.9% (-24.8, -9.1)	78/607 (12.9%)	-.2% (-3.8, 3.4)	13.9%	-8.1% (-27.0, 10.8)
Outcome 2: HIV counselling received										
2009	38/590 (6.4%)		38/855 (4.4%)		56/211 (26.5%)		24/753 (3.2%)		10.2%	
2010	72/475 (15.2%)	8.7% (4.9, 12.5)	20/263 (7.6%)	3.2% (-.3, 6.6)	30/184 (16.3%)	-10.2% (-18.2, -2.2)	54/411 (13.1%)	10% (6.5, 13.5)	13.1%	0.1% (-13.0, 13.2)
2012	81/532 (15.2%)	8.8% (5.1, 12.4)	13/408 (3.2%)	-1.3% (-3.5, .9)	21/241 (8.7%)	-17.8% (-24.8, -10.9	53/607 (8.7%)	5.5% (3, 8.1)	9.0%	-11% (-32.6, 10.6)
	Comparison									
	Facility E		Facility F		Facility G		Facility H		All comparison facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	24/220 (10.9%)		52/317 (16.4%)		72/146 (49.3%)		42/169 (24.9%)		25.4%	
2010	57/215 (26.5%)	15.6% (8.4, 22.8)	30/333 (9%)	-7.4% (-12.5, -2.3)	6/170 (3.5%)	-45.8% (-54.4, -37.2	5/35 (14.3%)	-10.6% (-23.9, 2.7)	13.3%	-10.8% (-29.2, 7.7)
2012	141/380 (37.1%)	26.2% (19.8, 32.6)	154/347 (44.4%)	28% (21.3, 34.6)	31/114 (27.2%)	-22.1% (-33.6, -10.6	39/287 (13.6%)	-11.3% (-18.9, -3.6)	30.6%	0.6% (-19.5, 18.2)
Outcome 2: HIV counselling received										
2009	10/220 (4.5%)		27/317 (8.5%)		44/146 (30.1%)		24/169 (14.2%)		14.4%	
2010	29/215 (13.5%)	8.9% (3.6, 14.3)	13/333 (3.9%)	-4.6% (-8.3, -.9)	4/170 (2.4%)	-27.8% (-35.6, -20)	3/35 (8.6%)	-5.6% (-16.3, 5)	7.1%	-10.1% (-23.1, 3.0)
2012	114/380 (30%)	25.5% (20.1, 30.8)	202/347 (58.2%)	49.7% (43.7, 55.7)	18/114 (15.8%)	-14.3% (-24.4, -4.3)	18/287 (6.3%)	-7.9% (-13.9, -2)	27.6%	3.4% (-18.2, 25.0)

†Unadjusted cluster-level proportions analysed separately at each time point. ‡Change from baseline adjusted for facility size and rural/urban status. All confidence intervals are at 95% confidence level.

Combinations of HIV/STI and MCH services received

In 2009, at least one client in every facility received each type of HIV-MCH integration investigated; that is, one or more clients received integration of HIV-FP (provision and counselling), HIV-ANC, HIV-PNC (for mother or baby), HIV-cervical screening (HIV-CS), and HIV-child health (HIV-CH). Figure 1 shows the proportion of visits in which each service combination was received at each facility. The most common integration in 2009 was HIV with child health services (up to 33% of all visits in Facility G), followed by HIV-ANC and HIV-FP (counselling or provision). Less frequent was integration of HIV services with PNC (a maximum of 6% of visits in Facility C) or cervical screening (maximum 6% of visits in Facility D).

In 2010, integration of HIV services with the MCH services no longer occurred in every facility. For example, in three facilities there were zero visits in which integration of HIV services and family planning occurred; ~~. And~~ in one intervention and all comparison facilities there was no integration of HIV services and cervical screening services; and ~~disappeared in one intervention and all comparison facilities, while~~ in two comparison sites, there were no cases of HIV-ANC and HIV-PNC integration ~~disappeared in two comparison sites~~. Excluding the latter two sites, integration of HIV-ANC was the most common type of integration in 2010. Between 2009 and 2012, HIV integration with FP counselling rose in facilities A, E and F - the same facilities that experienced increases in overall HIV-MCH integration. HIV-FP counselling integration declined in the other facilities, and integration of HIV and PNC services – the focus of the intervention – remained low in all facilities over time.

Receipt of HIV counselling

As a secondary outcome, we hypothesised that HIV counselling would increase in the intervention facilities. Table 2 shows that the proportion of visits in which a client received HIV counselling increased between 2009 and 2012 in two intervention (A,D) and two comparison facilities (E,F), and declined in two intervention sites (Facility C) and two comparison sites (G,H). The absolute numbers of visits that included HIV counselling are presented in Figure 2, which also shows that HIV counselling was more often provided in combination with an MCH service than alone. Specifically, HIV counselling was most often provided together with ANC, FP counselling or child health services (data not shown).

Evidence of an intervention effect

As shown in Table 2 (final column), there was no statistical evidence that integration increased over time in intervention facilities as a group. On average, the intervention facilities provided integrated services in 16 percent of visits in 2009 and 14 percent in both 2010 and 2012. Nor was there statistical evidence that the proportion of visits providing HIV counselling increased in the intervention group (averaging 10% in 2009 and 9% in 2012). In the comparison group, both overall HIV-MCH integration and HIV counselling increased between 2009 and 2012 (by 5 and 13 percentage points) after experiencing a decline in 2010. For these differences, 95% confidence intervals include the null value of zero. Between the intervention and comparison groups, there was no statistical difference in change from baseline levels of HIV-MCH integration or provision of HIV counselling (data not shown).

DISCUSSION

With what we believe are among the most detailed data on HIV-MCH integration in the public sector in Africa, we have been able to assess the extent to which clients are receiving integrated services, and in which combinations over time. The client flow assessments have shown that HIV/STI services (counselling, testing and treatment) are being integrated with a wide range of MCH services, including family planning, ante-natal care, post-natal care, cervical screening and child health services. This is evidence of the capacity to integrate, in large urban facilities as well as small, rural facilities across Swaziland. It also fills a current gap in evidence – regarding the feasibility of integrating HIV services with infant/child health services, and postnatal/postpartum services. A recent systematic review of integration evaluations identified both models as 'inadequately studied' to date.[9]

Nevertheless, integration occurred in a minority of visits and varied considerably across facilities. Furthermore, the level of integration fell in three of the eight facilities between 2009 and 2012. The facility with the highest level of integration in 2009 dropped to the lowest a year later (from 49% to <2%). This may be explained by the existence of an NGO campaign to increase access to ART in the area of that facility during the 2010 assessment, as HIV treatment appears to have displaced almost all other HIV and MCH services. This suggests that integration can be susceptible to vertical programmes or competing priorities, particularly in smaller facilities where the 2010 declines in integration were steepest.

It is also possible that integration declined in settings where clients did not need HIV services with every visit. The CFA did not capture clients' history or need for such services, and thus we

cannot interpret observed changes in their provision. For this reason we were particularly interested in the provision of HIV counselling, which can be promoted regardless of need for testing or treatment. HIV counselling rose in two intervention and two comparison facilities. In the three sites where HIV-MCH integration rose, this appeared to be driven by an increase in HIV counselling. That HIV counselling was most often provided with an MCH service rather than alone suggests it has a~~n important~~ role to play in scaling up integration, but requires a concerted effort to sustain its provision.

The most common form of integration observed was between HIV services and child health, followed by ANC and FP. These services may offer the best opportunities for integration with HIV, given most women attended for child health, ANC and FP services. This is particularly encouraging in light of a recent review concluding that uptake of PMTCT in sub-Saharan Africa is inadequate, but improves with an integrated family-centred approach, for example, if HIV treatment is provided at antenatal clinics.[7]

Less common was integration of HIV/STI with PNC or cervical screening, most likely due to the lower number of clients receiving PNC and cervical screening relative to other services (or PNC clients may have received HIV/STI testing in recent ANC visits). This suggests that potential effectiveness of the Integra Initiative – which focuses on HIV-PNC integration in Swaziland – may be limited until more clients attend for PNC services. And this may require further investment in equipment and training for PNC (as well as cervical screening, as only one facility had the capacity to offer immediate cryotherapy) as well as demand creation to increase service uptake.

The formal comparison of integration by study design (intervention versus comparison sites) showed no statistical difference in HIV-MCH integration over time. Neither was there a meaningful difference in the receipt of HIV counselling in the intervention group over time.

Limitations and the challenges of embedding research in 'real-world' settings

The observed changes in levels of integration, and absence of an intervention effect, could be due to a number of factors which we were unable to account for given the non-randomised design, as well as challenges implementing the protocol as intended.

With regard to design: in a small country with limited number of facilities, intervention sites could not be matched with similar-sized comparison facilities ~~without risk of contamination~~. This resulted in systematically different groups, with intervention facilities primarily large and urban, and comparison facilities mostly small and rural. Given the resulting heterogeneity, and the focus on a facility-specific outcome in this analysis, we felt it was more informative to compare changes by facility than study design. The wide variation we observed across facilities likely reflects the different capacities and infrastructure available to provide integrated services, i.e., facilities can not follow the same 'blue print' for integration, particularly given the variability in facility size, client volumes and staffing levels among the eight study facilities. Detailed case studies are underway to explore the role of facility differences in greater depth, including intervention dose and quality, as well as contextual information, to enhance interpretation of the levels and patterns of integration revealed by the client flow assessments.

Some observed changes may also be due to 'seasonal' differences in 2009 and 2010. Coordinating client flow assessments across eight facilities proved logistically challenging and synchronicity was not always achieved as intended. ~~For logistical reasons, the client flow assessments were delayed in 2010 and could not be conducted in the same week in November as in 2009. And specific circumstances in some facilities meant the assessments could not be simultaneous in all sites, as the protocol had intended.~~ In 2010, ~~M~~most assessments were delayed until the week before Christmas (as compared to November 2009) which may account for the smaller number of clients in most facilities in 2010. This timing may have affected the range of services provided and may account for different patterns of integration. Smaller, rural facilities – where the drops in integration were the steepest - may be impacted more than large, rural sites during such holiday periods.

It is also possible that provision of HIV and MCH services may fluctuate frequently or periodically, in patterns we could not detect from 5-day 'snapshot' assessments (regardless of their specific timing). An early evaluation of CDC's 'patient flow analysis' method, conducted over one day in family planning clinics in Kenya, concluded that: "the 'typical' clinic day does not really exist. The client/patient load and staffing patterns are likely to vary according to many factors: by day of the week, or season of the year, staff vacation or sickness, etc."[14] Assessments were extended to five days in this study, yet, neither does the 'typical' clinic week exist. It may be more informative to monitor over a longer period, for more representative data. ~~Yet~~However, the 5-day assessments proved challenging and resource-intensive to implement, and longer versions may be prohibitive in many settings. Previous evaluations of patient flow analyses also note that data may not be representative since staff – aware of the

assessment – may try to perform at their best.[14] For these reasons, ~~S~~strengthening routine data collection systems may be preferable, but many existing systems record services individually in separate registers, and are thus unable to document service integration without fundamentally changing the system. It was this barrier that led us to ~~develop~~ utilise the client flow assessment.

Conclusions

The client flow assessment provided rich detail about the range and combinations of services received by large number of clients. This was valuable for understanding whether and how HIV and MCH services are integrated in practice. The data confirm that, in a context of high HIV prevalence, capacity exists in public sector services for integration of HIV services into MCH care. In particular, ANC, child health and family planning provide promising entry-points for reaching the largest number of women. Sustaining HIV-MCH integration may require concerted effort over time. The study limitations reflect the challenges of embedding rigorous research into existing and diverse facilities (i.e., 'real-world' evaluations), and difficulties in recording the provision of integrated services.

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Author contributions

SM, JK, CW, KC, RN helped to design the data collection. JK managed the data collection. JF and WZ cleaned and managed the datasets. IB and JF led the analysis. All authors provided input into the data interpretation. IB drafted the manuscript. All authors read and commented on a complete draft.

Data sharing

The dataset will be made available via an LSHTM repository upon completion of the Integra Initiative.

Competing interests statement

The authors have declared that no competing interests exist.

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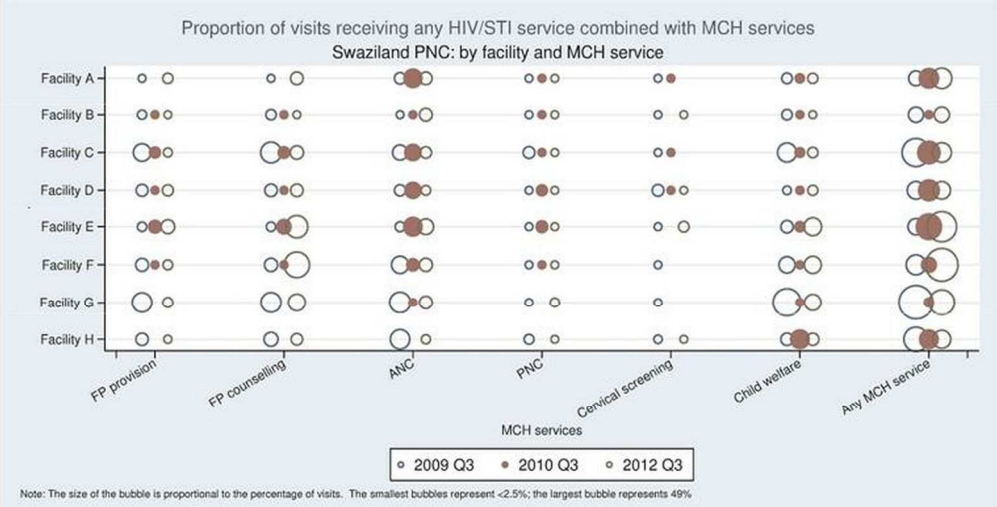

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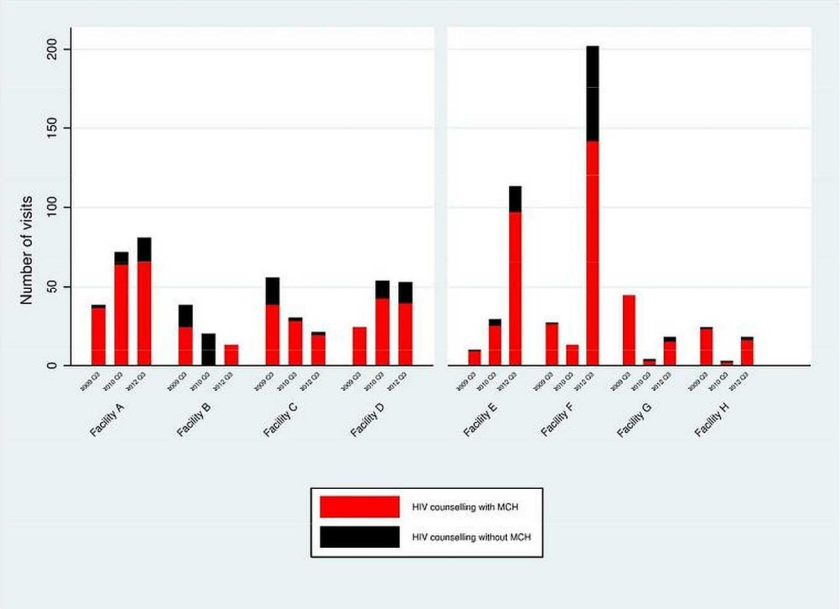

Figure 2. Number of visits receiving any HIV counselling services, by facility and integration with MCH services

Figure 2. Number of visits receiving any HIV counselling services, by facility and integration with MCH services

128x90mm (300 x 300 DPI)

Supplementary Table 1. Characteristics of the facilities *

Intervention	Facility A	Facility B	Facility C	Facility D
Type of facility	Public Health Unit	Public Health Unit	Hospital	Hospital
Inpatient beds (#)	0	0	200	350
Outpatient visits per year (#)	44,280	43,671	22,820	219,943
Staff (#) ^				
Clinical	22	20	43	214
Technical	2	1	93	58
Admin/management	2	1	3	5
Services provided	FP; PNC; STI management; general SRH counselling; Ca Cx screening; PITC; ART clinic; CD4 count (samples drawn in ART unit). ART services since March 2011	Static services: Tx of opportunistic infections, ART initiation & refills to HIV-positive PNC & ANC clients & families; ANC; FP; PNC; dental services; curatives; Lab services; child welfare clinic; STI management. Outreach clinics provide child welfare, PNC, FP, curatives, STI treatment	FP; PNC; Ca Cx Screening; PMTCT; STI management; General SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU and ART unit); TB screening & treatment (TB unit)	FP; PNC; Ca Cx Screening; PMTCT; STI management; general SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU & ART unit); TB screening & treatment (TB unit)

Comparison	Facility E	Facility F	Facility G	Facility H
Type of facility	Health Centre	Health Centre	Health Centre	Health Centre
Inpatient beds (#)	35	40	0	0
Outpatient visits per year (#)	12,770	63,809	25,513	24,062
Staff (#)				
Clinical	33	50	28	214
Technical	17	23	11	58
Admin/management	2	27	12	5
Services provided	FP; PNC; STI management; Maternity/Gynae; General SRH counselling; Ca CX Screening (clients referred); PITC; ART clinic; CD4 count (samples drawn in PHU, ART & TB units); TB screening & treatment (TB unit)	FP; PNC; PMTCT; STI management; general SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU & ART unit); TB screening & treatment (TB unit)	FP; PNC; PMTCT; STI management; general SRH counselling; PITC; ART clinic; VCT (since June 2011; CD4 count (samples drawn in PHU and ART unit); TB screening & treatment (TB unit)	FP; PNC; PMTCT; STI management; general SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU & ART unit); TB screening & treatment (TB unit)

*Taken from health facility assessments conducted for the Integra Initiative in 2010

^ Clinical staff include staff nurses, nursing assistants, doctors, dentists, paramedics and medical officers ; Technical staff include radiographers, medical technologists, lab technicians/assistants, phlebotomists, pharmacists, environmental health officers, mentor mothers, expert clients, cough officers, lay counsellors; Administrative staff include managers, senior nurses, matrons, health administrators, data clerks, orderlies.

Supplementary Table 21. Proportion of visits in which key HIV/STI and MCH services were received, by facility and year

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
N	590	475	532	855	263	408	211	184	241	753	411	607
HIV/STI services received												
HIV testing	40 (6.8%)	39 (8.2%)	125 (23.5%)	20 (2.3%)	6 (2.3%)	14 (3.4%)	13 (6.2%)	8 (4.3%)	15 (6.2%)	10 (1.3%)	29 (7.1%)	33 (5.4%)
HIV counselling	38 (6.4%)	72 (15.2%)	81 (15.2%)	38 (4.4%)	20 (7.6%)	13 (3.2%)	56 (26.5%)	30 (16.3%)	21 (8.7%)	24 (3.2%)	54 (13.1%)	53 (8.7%)
HIV treatment	4 (.7%)	9 (1.9%)	14 (2.6%)	139 (16.3%)	21 (8%)	70 (17.2%)	29 (13.7%)	10 (5.4%)	108 (44.8%)	65 (8.6%)	1 (.2%)	78 (12.9%)
PMTCT	0 (0%)	30 (6.3%)	27 (5.1%)	0 (0%)	1 (.4%)	24 (5.9%)	0 (0%)	7 (3.8%)	7 (2.9%)	0 (0%)	71 (17.3%)	28 (4.6%)
STI counselling & testing	13 (2.2%)	0 (0%)	49 (9.2%)	65 (7.6%)	49 (18.6%)	9 (2.2%)	46 (21.8%)	1 (.5%)	5 (2.1%)	59 (7.8%)	5 (1.2%)	28 (4.6%)
Any HIV/STI service	57 (9.7%)	83 (17.5%)	202 (38%)	218 (25.5%)	74 (28.1%)	109 (26.7%)	92 (43.6%)	47 (25.5%)	135 (56%)	138 (18.3%)	87 (21.2%)	159 (26.2%)
MCH services received												
Family planning provision	176 (29.8%)	97 (20.4%)	105 (19.7%)	147 (17.2%)	38 (14.4%)	63 (15.4%)	56 (26.5%)	46 (25%)	18 (7.5%)	67 (8.9%)	40 (9.7%)	100 (16.5%)
Family planning counselling	65 (11%)	44 (9.3%)	93 (17.5%)	84 (9.8%)	9 (3.4%)	52 (12.7%)	70 (33.2%)	19 (10.3%)	33 (13.7%)	77 (10.2%)	40 (9.7%)	130 (21.4%)
ANC	145 (24.6%)	74 (15.6%)	49 (9.2%)	102 (11.9%)	19 (7.2%)	78 (19.1%)	49 (23.2%)	46 (25%)	20 (8.3%)	322 (42.8%)	48 (11.7%)	86 (14.2%)
PNC (mother or baby)	53 (9%)	35 (7.4%)	11 (2.1%)	32 (3.7%)	10 (3.8%)	16 (3.9%)	16 (7.6%)	9 (4.9%)	10 (4.1%)	54 (7.2%)	23 (5.6%)	28 (4.6%)
Cervical screen	2 (.3%)	1 (.2%)	3 (.6%)	8 (.9%)	0 (0%)	2 (.5%)	3 (1.4%)	1 (.5%)	0 (0%)	348 (46.2%)	1 (.2%)	11 (1.8%)
Child health (incl. Immunization)	320 (54.2%)	277 (58.3%)	174 (32.7%)	319 (37.3%)	90 (34.2%)	157 (38.5%)	93 (44.1%)	81 (44%)	47 (19.5%)	155 (20.6%)	128 (31.1%)	268 (44.2%)
Other reproductive health service	1 (.2%)	0 (0%)	1 (.2%)	11 (1.3%)	7 (2.7%)	4 (1%)	2 (.9%)	1 (.5%)	5 (2.1%)	58 (7.7%)	27 (6.6%)	0 (0%)
Any MCH service	550 (93.2%)	441 (92.8%)	326 (61.3%)	543 (63.5%)	147 (55.9%)	313 (76.7%)	175 (82.9%)	167 (90.8%)	106 (44%)	610 (81%)	256 (62.3%)	476 (78.4%)
Comparison	**Facility E**			**Facility F**			**Facility G**			**Facility H**		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
N	220	215	380	317	333	347	146	170	114	169	35	287
HIV/STI services received												
HIV testing	14 (6.4%)	16 (7.4%)	33 (8.7%)	14 (4.4%)	4 (1.2%)	16 (4.6%)	19 (13%)	0 (0%)	16 (14%)	22 (13%)	0 (0%)	6 (2.1%)
HIV counselling	10 (4.5%)	29 (13.5%)	114 (30%)	27 (8.5%)	13 (3.9%)	202 (58.2%)	44 (30.1%)	4 (2.4%)	18 (15.8%)	24 (14.2%)	3 (8.6%)	18 (6.3%)
HIV treatment	9 (4.1%)	12 (5.6%)	31 (8.2%)	18 (5.7%)	7 (2.1%)	173 (49.9%)	41 (28.1%)	78 (45.9%)	48 (42.1%)	4 (2.4%)	0 (0%)	96 (33.4%)
PMTCT	0 (0%)	28 (13%)	50 (13.2%)	0 (0%)	18 (5.4%)	15 (4.3%)	0 (0%)	9 (5.3%)	7 (6.1%)	0 (0%)	6 (17.1%)	16 (5.6%)
STI counselling & testing	8 (3.6%)	13 (6%)	43 (11.3%)	24 (7.6%)	0 (0%)	101 (29.1%)	15 (10.3%)	0 (0%)	3 (2.6%)	25 (14.8%)	0 (0%)	7 (2.4%)
Any HIV/STI service	30 (13.6%)	64 (29.8%)	176 (46.3%)	57 (18%)	36 (10.8%)	253 (72.9%)	74 (50.7%)	91 (53.5%)	69 (60.5%)	45 (26.6%)	7 (20%)	123 (42.9%)
MCH services received												
Family planning provision	52 (23.6%)	57 (26.5%)	100 (26.3%)	73 (23%)	128 (38.4%)	39 (11.2%)	47 (32.2%)	12 (7.1%)	17 (14.9%)	43 (25.4%)	8 (22.9%)	32 (11.1%)
Family planning counselling	23 (10.5%)	64 (29.8%)	148 (38.9%)	41 (12.9%)	38 (11.4%)	117 (33.7%)	44 (30.1%)	6 (3.5%)	23 (20.2%)	43 (25.4%)	7 (20%)	50 (17.4%)
ANC	45 (20.5%)	41 (19.1%)	58 (15.3%)	199 (62.8%)	83 (24.9%)	40 (11.5%)	49 (33.6%)	7 (4.1%)	13 (11.4%)	49 (29%)	0 (0%)	21 (7.3%)
PNC (mother or baby)	2 (.9%)	17 (7.9%)	14 (3.7%)	17 (5.4%)	20 (6%)	3 (.9%)	5 (3.4%)	1 (.6%)	9 (7.9%)	11 (6.5%)	1 (2.9%)	16 (5.6%)
Cervical screen	2 (.9%)	0 (0%)	23 (6.1%)	3 (.9%)	0 (0%)	0 (0%)	2 (1.4%)	0 (0%)	0 (0%)	6 (3.6%)	0 (0%)	2 (.7%)
Child health (incl. Immunization)	135 (61.4%)	102 (47.4%)	118 (31.1%)	198 (62.5%)	111 (33.3%)	84 (24.2%)	81 (55.5%)	43 (25.3%)	22 (19.3%)	62 (36.7%)	31 (88.6%)	89 (31%)
Other reproductive health service	0 (0%)	0 (0%)	3 (.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1.8%)	1 (.6%)	0 (0%)	3 (1%)
Any MCH service	204 (92.7%)	204 (94.9%)	312 (82.1%)	311 (98.1%)	322 (96.7%)	238 (68.6%)	133 (91.1%)	63 (37.1%)	61 (53.5%)	133 (78.7%)	33 (94.3%)	165 (57.5%)

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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Title

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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ABSTRACT

Objective

Maternal and child health (MCH) care may provide an entry point for HIV services in high HIV-prevalence settings. Our objective was to assess integration of HIV with MCH services in public sector facilities in Swaziland.

Design

In 2009, 2010 and 2012, client flow assessments were conducted over five days in the MCH units of eight government facilities, purposively selected as intervention or comparison sites.

Participants

8263 MCH visits with female clients were tracked: 3261 in 2009; 2086 in 2010; and 2916 in 2012.

Intervention

Activities and resources to strengthen integration of HIV services into post-natal care, 2009 - 2010.

Main outcome measures

(1) The proportion of all visits in which an HIV/STI testing, counselling or treatment was received together with an MCH service;

(2) The proportion of all visits in which a client receives HIV counselling.

Results

Across facilities, the proportion of visits in which both HIV/STI and MCH services were received varied considerably, e.g., from 9%-49% in 2009. HIV/STI services were integrated most frequently with child health, ante-natal care (ANC) and family planning – the most common reasons for women's attendance – and least often with post-natal care (PNC) and cervical screening. There was no meaningful difference in integration over time by design group, and considerable heterogeneity across facilities. Receipt of integrated services increased in one intervention and two comparison facilities, where HIV counseling also rose, and fell in one intervention and two comparison facilities.

Conclusions

Provision of HIV/STI services with MCH care occurred at all facilities, yet relatively few women receive integrated services. Increases in integration were driven by increases in HIV counseling while sharp declines in some facilities indicate integration is difficult to sustain. Opportunities for intensifying HIV integration lie with ANC, child health and family planning, while HIV-PNC integration will remain limited until more women attend PNC.

Trial registry and number

Current Controlled Trials NCT01694862

ARTICLE SUMMARY

Article focus

- Maternal health care may provide an entry point for HIV services in high HIV-prevalence settings, yet little is known about actual integration of HIV with maternal care – or how integrated provision can be improved – in public sector facilities.
- Client flow assessments were conducted over five days in MCH units of eight facilities in Swaziland in 2009, 2010 and 2012 (N=8263 visits tracked) to determine the extent to which HIV/STI services were received with MCH services in the same visit, and in what combinations.
- We also assessed whether these outcomes improved with time in facilities which received an intervention designed to strengthen integration of HIV into post-natal care services (the Integra Initiative).

Key messages

- Some provision of HIV/STI services with MCH care occurred at all facilities, indicating a capacity to integrate services in the public sector, yet relatively few women receive integrated services.
- In three facilities, increases in integration over time were driven by increases in HIV counselling. Sharp declines in other facilities suggest integration is difficult to sustain, given frequent staff rotation and vertical HIV treatment campaigns that can divert resources for integration.

- There was no evidence of an increase in integration in three of four intervention facilities. Impact of the intervention to strengthen integration of HIV into PNC will remain limited until more women attend PNC; the best opportunities for scaling up HIV integration may lie with ANC, child health and family planning, given their frequent use.

Strengths and limitations of this study

- The main strength is the scale and novelty of client flow data in public sector facilities in sub-Saharan Africa, offering detailed combinations of services received in every consultation. Such detail is typically unavailable from routine health information systems.
- An important limitation is the logistical challenge in conducting client flow assessments simultaneously across eight government facilities, affecting comparability of data across facilities and time points.

INTRODUCTION

Maternal mortality and HIV have been described as "intersecting epidemics" which must be simultaneously tackled.[1, 2] In the setting for this study – Swaziland, where more than 40% of pregnant women are infected with HIV – HIV is intimately linked with maternal mortality and hinders efforts to lower maternal death rates.[3, 4]

Since the International Conference on Population and Development in 1994, a strong case has been made for integrating HIV services into sexual and reproductive health (SRH) with potential benefits for both clients and facilities.[5, 6] Integration can simultaneously address clients' reproductive health goals and their needs for HIV prevention and treatment and PMTCT.[7] Process evaluations of integrated HIV and family planning (FP) services indicate that facilities can gain by increasing the provision, uptake and efficiency of services while improving client satisfaction and reducing HIV-related stigma in clinics.[8]

More recently, the case for expanding integration of HIV/AIDS services to maternal, neonatal, child health and nutrition, including family planning, is supported in a systematic review which concludes that integration of such services is feasible to implement under certain circumstances.[9] Furthermore, such integration can yield positive effects on the quality of services as well as client outcomes including contraceptive use, antiretroviral therapy in pregnancy, and HIV testing.[9]

Maternal and child health services can thus serve as entry points for HIV prevention, treatment and care, particularly in contexts of high HIV prevalence. Yet little is known about existing

levels of integration, particularly in public sector health facilities, or how provision can be improved and scaled up.[8]

The Integra Initiative is a large-scale non-randomised evaluation designed to assess different models of SRH-HIV integration, including the integration of HIV/STI services with post-natal care (PNC) in Swaziland. Although not a randomised controlled trial, Integra was registered for good practice and transparency (Current Controlled Trials NCT01694862). The specific models of integration and their hypothesised benefits for clients and health care efficiency are detailed in the Integra study protocol.[10] In brief, Integra defines integration as the provision of two or more services in the same visit, with the model in Swaziland focusing on post-natal care as an entry point for HIV/STI counselling, testing and/or treatment services.

As part of the Integra Initiative, this study analysed client flow data collected in eight public sector facilities in Swaziland in 2009, 2010 and 2012, to determine whether clients seeking maternal and child health services (MCH) receive integrated services, and if so, in what combinations of HIV/STI and MCH services.[10] We also sought to understand how the receipt of integrated services differs over time and between facilities which did and did not receive the Integra intervention. We hoped the answers would help identify gaps and opportunities for integrating HIV within maternal health services and achieving universal access to both.

METHODS

Data Collection

As part of Integra's non-randomised design, eight public sector facilities were selected from three of Swaziland's four regions. Four facilities were purposively designated as Intervention

facilities (referred to as Facilities A-D), based on their previous participation in an operations research study by Population Council, one of the Integra institutional partners.[11] Four comparison facilities were selected based on their distance from intervention sites (to avoid contamination) and no current (at the time in 2008) provision of integrated HIV-PNC services (Facilities E-H), as determined by discussions with the Ministry of Health and site visits by Population Council.

In the intervention facilities, between October 2009 and December 2010, Integra delivered a programme designed to strengthen and maintain the provision of integrated HIV and PNC services. The intervention components included: (a) a training package to facilitate mentoring of front-line health providers by more experienced providers; (b) job aids to promote integration, including the Balanced Counselling Strategy Plus (BCS+) toolkit containing an algorithm, counselling cards and brochures to support counselling, including HIV service provision, within PNC consultations;[11, 12] and (c) ongoing support to discuss role clarification, organisational change, referral/linkages and management of service statistics.

The client flow assessments (CFAs) comprise one data component of the Integra evaluation. The CFAs were modelled on the Patient Flow Analysis, a method developed by the Centers for Disease Control in the 1970s to track patients' movements through a clinic over one day,[13, 14] and shown to be effective in measuring intervention effectiveness within the context of usual practice.[15] In this context, CFAs were designed to capture service utilisation patterns among clients seeking MCH services, given that data on integrated service provision were not available from routine clinical data (which collect data on different services in separate

registers). Specifically, CFAs were conducted in all study facilities in November 2009, December 2010, and August 2012. Over a period of five days, Monday through Friday, all clients entering the facility for MCH health services were given a client flow form by teams of trained local researchers or service providers. Clients carried the form throughout their visit, and each service provider they saw completed the form in their consultation room/cubicle, indicating session start/end times, the service(s) received by the client and any referrals to other providers.

The first CFA (late November 2009) was conducted soon after the intervention began in October 2009, but before it was fully implemented in any site. For logistical reasons, the client flow assessments could not be conducted in the same week of each year. And specific circumstances in some facilities meant the assessments could not be simultaneous in all eight sites, as the protocol had intended. In some facilities, with the support of facility managers, client flow assessments were conducted for more than the five days intended. To preserve the original protocol design, we restricted this analysis to the first Monday through Friday on which data were collected.

Data analysis

We defined our unit of analysis to be a visit, which comprised all providers seen and services received in the same day for each client, as captured on the client assessment form. Clients were either a single adult or an adult plus a child. We excluded visits of males aged 12 years or over, to focus on maternal and child health services. The age of 12 was selected as reproductive health services were received by females as young as 12.

The following primary and secondary outcomes were calculated for each facility and time point:

1. Receipt of integrated HIV-MCH services: the proportion of all visits in which a client receives any HIV or STI service, specifically: HIV testing, counselling or treatment; PMTCT; or STI counselling or testing

   and

   any of the following MCH services: FP counselling or provision; PNC for mother or baby; cervical cancer screening; child health (including weighing and immunisations); and antenatal care (ANC).

   We hypothesised that HIV-MCH integration would increase in facilities which received the Integra intervention.

2. Receipt of HIV counselling: the proportion of all visits in which a client receives HIV counselling.

   We hypothesised that HIV counselling would increase as a result of the Integra intervention, regardless of women's need for HIV testing or treatment which are not constant (medical histories, including the need for testing or treatment, were not captured on the CFA form).

We also sought to describe which MCH services were most commonly combined with HIV/STI services, by calculating the percentage of visits in which an HIV/STI service was combined with each type of MCH service. We examined the change over time in the proportion of visits receiving integrated HIV/STI and MCH services (primary outcome) and HIV counselling

(secondary outcome) separately for each facility. We used the 95% confidence interval around the difference (in the 2010 and 2012 proportions compared to 2009) as an indication of whether the observed change was due to chance (if it included the null value of zero).

To examine differences in the key outcomes by design group, we calculated the risk difference in 2010 and 2012 (each compared to 2009) for intervention versus comparison facilities for both the primary and secondary outcomes using a two-stage approach. In the first stage we estimated facility-level residuals by fitting a logistic regression model and including terms to adjust for baseline value (corresponding proportion of visits in 2009), average annual client load (<10000, 10000+), and rural/urban status. Difference residuals were then obtained as the difference between the observed and predicted values (divided by facility size). In the second stage we analysed the facility-level residuals, based on the assumption that in the absence of any intervention effect the residuals should be distributed normally with no systematic difference between the intervention and comparison arms. Difference residuals were analysed using linear regression including an interaction term representing the difference in 'change from baseline' between the design groups.

Ethics Statement

Ethics approval for the client flow assessments was obtained from the Swaziland Scientific Review Board, the London School of Hygiene & Tropical Medicine and the Population Council Institutional Review Board.

RESULTS

Across eight facilities, 3261 visits were tracked in November 2009, 2086 visits in December 2010, and 2916 in August 2012. Table 1 presents general characteristics of the visits and facilities. Additional details about each facility are provided in Supplementary Table 1. Overall, about half of the visits included an adult female and child (under 12 years), versus an adult client only, although this proportion varied across facilities (range: 28%-95%). In almost all facilities, clients received on average more than one service during their visit, with many receiving two or more. Each year, approximately eight percent of clients did not receive any service or referral during their visit, with the highest proportions in the facilities with highest client load (e.g., 18% of clients in Facility B and 31% in Facility D in 2010). In all facilities, and in both years, child health services were either the first or second most common service received. Family planning counselling or provision, and ante-natal care, were among the top three services for most facilities. Across facilities, the least common services received were post-natal care and cervical screening (See Supplementary Table 2).

Table 1. Characteristics of the facilities, visits and services tracked in 2009, 2010 and 2012

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	590	475	532	855	263	408	211	184	241	753	411	607
Client category												
Adult (12+ years) only	395 (66.9%)	196 (41.3%)	211 (39.7%)	443 (51.8%)	153 (58.2%)	172 (42.2%)	144 (68.2%)	87 (47.3%)	82 (34%)	310 (41.2%)	197 (47.9%)	408 (67.2%)
Adult + child	176 (29.8%)	278 (58.5%)	320 (60.2%)	153 (17.9%)	109 (41.4%)	236 (57.8%)	64 (30.3%)	97 (52.7%)	156 (64.7%)	93 (12.4%)	213 (51.8%)	198 (32.6%)
Adult age												
Mean [sd]	26.2 [6.4]	26.2 [7.2]	26.3 [6.5]	26.8 [8.2]	27 [7.2]	26.6 [7.3]	28.5 [8.4]	26.8 [8]	27.7 [8.5]	27.6 [7.4]	27.3 [8.4]	31.3 [10.2]
Missing	9 (1.5%)	258 (54.3%)	17 (3.2%)	357 (41.8%)	40 (15.2%)	13 (3.2%)	2 (.9%)	2 (1.1%)	1 (.4%)	382 (50.7%)	165 (40.1%)	12 (2%)
Services received per visit												
None	37 (6.3%)	24 (5.1%)	88 (16.5%)	134 (15.7%)	47 (17.9%)	23 (5.6%)	11 (5.2%)	6 (3.3%)	32 (13.3%)	93 (12.4%)	129 (31.4%)	29 (4.8%)
One	319 (54.1%)	106 (22.3%)	192 (36.1%)	479 (56%)	145 (55.1%)	208 (51%)	47 (22.3%)	57 (31%)	114 (47.3%)	246 (32.7%)	135 (32.8%)	238 (39.2%)
Two or more	234 (39.7%)	345 (72.6%)	252 (47.4%)	242 (28.3%)	71 (27%)	177 (43.4%)	153 (72.5%)	121 (65.8%)	95 (39.4%)	414 (55%)	147 (35.8%)	340 (56%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.3]	2.5 [1.4]	2.6 [2]	1.6 [1.1]	1.4 [.8]	2 [1.6]	2.6 [1.7]	2 [1]	1.9 [1.3]	2.1 [1.2]	2 [1.3]	2 [1.3]
Mean [sd] providers seen	1.3 [.5]	1.5 [.5]	1.6 [.9]	1.2 [.4]	1 [.2]	1.4 [.7]	1.3 [.5]	1.1 [.4]	1.3 [.5]	1.5 [.7]	1.5 [.7]	1.1 [.3]
Visits where no services were either referred or received	36 (6.1%)	22 (4.6%)	88 (16.5%)	112 (13.1%)	47 (17.9%)	15 (3.7%)	7 (3.3%)	6 (3.3%)	16 (6.6%)	81 (10.8%)	69 (16.8%)	29 (4.8%)
Average annual client load*		32,321			65,794			9,974			40,485	
Setting (urban/rural)		Urban			Urban			Peri-urban			Urban	

Comparison	Facility E			Facility F			Facility G			Facility H		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	220	215	380	317	333	347	146	170	114	169	35	287
Client category												
Adult (12+ years) only	131 (59.5%)	72 (33.5%)	234 (61.6%)	194 (61.2%)	183 (55%)	154 (44.4%)	74 (50.7%)	106 (62.4%)	47 (41.2%)	110 (65.1%)	2 (5.7%)	178 (62%)
Adult + child	78 (35.5%)	143 (66.5%)	145 (38.2%)	117 (36.9%)	150 (45%)	193 (55.6%)	69 (47.3%)	64 (37.6%)	67 (58.8%)	48 (28.4%)	33 (94.3%)	107 (37.3%)
Adult age												
Mean [sd]	26 [7.5]	26 [5.9]	34.5 [12.6]	26.1 [6.2]	26.4 [6.3]	26.5 [7.4]	27.4 [7.8]	31.4 [10.8]	26.5 [7.2]	25.1 [6]	29.5 [10.6]	30.9 [11.9]
Missing	1 (.5%)	95 (44.2%)	53 (13.9%)	5 (1.6%)	124 (37.2%)	9 (2.6%)	0 (0%)	6 (3.5%)	5 (4.4%)	0 (0%)	33 (94.3%)	67 (23.3%)
Services received per visit												
None	10 (4.5%)	3 (1.4%)	13 (3.4%)	1 (.3%)	5 (1.5%)	8 (2.3%)	11 (7.5%)	6 (3.5%)	14 (12.3%)	31 (18.3%)	0 (0%)	29 (10.1%)
One	99 (45%)	34 (15.8%)	45 (11.8%)	100 (31.5%)	177 (53.2%)	46 (13.3%)	19 (13%)	84 (49.4%)	32 (28.1%)	32 (18.9%)	8 (22.9%)	155 (54%)
Two or more	111 (50.5%)	178 (82.8%)	322 (84.7%)	216 (68.1%)	151 (45.3%)	293 (84.4%)	116 (79.5%)	80 (47.1%)	68 (59.6%)	106 (62.7%)	27 (77.1%)	103 (35.9%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.1]	2.4 [1.1]	3.2 [1.6]	2.3 [1.6]	1.6 [.9]	3.4 [1.6]	3.2 [1.6]	1.6 [.6]	2.6 [1.6]	2.7 [1.6]	2.8 [1.3]	1.8 [1.5]
Mean [sd] providers seen	1.3 [.5]	1.1 [.2]	1.7 [.7]	1.8 [.8]	1 [.2]	1.3 [.6]	1.5 [.5]	1.4 [.6]	1.3 [.6]	1.4 [.6]	1.1 [.3]	1.2 [.5]
Visits where no services were either referred or received	9 (4.1%)	2 (.9%)	12 (3.2%)	1 (.3%)	5 (1.5%)	7 (2%)	11 (7.5%)	5 (2.9%)	8 (7%)	3 (1.8%)	0 (0%)	21 (7.3%)
Average annual client load*		7,736			28,202			9,674			6,959	
Setting (urban/rural)		Rural			Peri-urban			Rural			Rural	

*Annual client load taken from health facility assessments conducted for the Integra Initiative in 2010. All tables are N (%) unless indicated otherwise.

Receipt of integrated HIV-MCH services

There was evidence of HIV-MCH integration at all facilities and time points, although the extent of integration (the proportion of visits in which integrated HIV-MCH services were received) varied by facility: specifically, between 9% and 49% in 2009, 2%-22% in 2010 and 10-44% in 2012 (see Table 2). In the short-term, five facilities experienced declines in integration between 2009 and 2010: by seven and 13 percentage points in two intervention facilities; and by 12, 19 and 48 percentage points in three comparison facilities. In the longer-term, integration increased in one intervention site (Facility A, from 9% in 2009 to 17% of visits in 2012) and two comparison facilities (Facility E, from 11% to 37%; and Facility F, from 16% to 44% in 2012, after experiencing an initial drop to 9% in 2010). Meanwhile, integration fell in one intervention site (Facility C, from 33% to 16%) and two comparison facilities (Facility G, from 49% to 27%; Facility H, from 25% to 14%). Two intervention facilities (B and D) experienced no significant change in HIV-MCH integration between 2009 and 2012.

Table 2. Proportion of visits receiving the primary and secondary outcomes, by facility, year and design group

	Intervention									
	Facility A		Facility B		Facility C		Facility D		All intervention facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	54/590 (9.2%)		83/855 (9.7%)		69/211 (32.7%)		98/753 (13%)		16.1%	
2010	74/475 (15.6%)	6.4% (2.4, 10.4)	6/263 (2.3%)	-7.4% (-10.1, -4.7)	38/184 (20.7%)	-12% (-20.7, -3.4)	73/411 (17.8%)	4.7% (.3, 9.2)	14.1%	-0.8% (-19.3, 17.7)
2012	91/532 (17.1%)	8% (4, 11.9)	40/408 (9.8%)	.1% (-3.4, 3.6)	38/241 (15.8%)	-16.9% (-24.8, -9.1)	78/607 (12.9%)	-.2% (-3.8, 3.4)	13.9%	-8.1% (-27.0, 10.8)
Outcome 2: HIV counselling received										
2009	38/590 (6.4%)		38/855 (4.4%)		56/211 (26.5%)		24/753 (3.2%)		10.2%	
2010	72/475 (15.2%)	8.7% (4.9, 12.5)	20/263 (7.6%)	3.2% (-.3, 6.6)	30/184 (16.3%)	-10.2% (-18.2, -2.2)	54/411 (13.1%)	10% (6.5, 13.5)	13.1%	0.1% (-13.0, 13.2)
2012	81/532 (15.2%)	8.8% (5.1, 12.4)	13/408 (3.2%)	-1.3% (-3.5, .9)	21/241 (8.7%)	-17.8% (-24.8, -10.9	53/607 (8.7%)	5.5% (3, 8.1)	9.0%	-11% (-32.6, 10.6)
	Comparison									
	Facility E		Facility F		Facility G		Facility H		All comparison facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	24/220 (10.9%)		52/317 (16.4%)		72/146 (49.3%)		42/169 (24.9%)		25.4%	
2010	57/215 (26.5%)	15.6% (8.4, 22.8)	30/333 (9%)	-7.4% (-12.5, -2.3)	6/170 (3.5%)	-45.8% (-54.4, -37.2	5/35 (14.3%)	-10.6% (-23.9, 2.7)	13.3%	-10.8% (-29.2, 7.7)
2012	141/380 (37.1%)	26.2% (19.8, 32.6)	154/347 (44.4%)	28% (21.3, 34.6)	31/114 (27.2%)	-22.1% (-33.6, -10.6	39/287 (13.6%)	-11.3% (-18.9, -3.6)	30.6%	0.6% (-19.5, 18.2)
Outcome 2: HIV counselling received										
2009	10/220 (4.5%)		27/317 (8.5%)		44/146 (30.1%)		24/169 (14.2%)		14.4%	
2010	29/215 (13.5%)	8.9% (3.6, 14.3)	13/333 (3.9%)	-4.6% (-8.3, -.9)	4/170 (2.4%)	-27.8% (-35.6, -20)	3/35 (8.6%)	-5.6% (-16.3, 5)	7.1%	-10.1% (-23.1, 3.0)
2012	114/380 (30%)	25.5% (20.1, 30.8)	202/347 (58.2%)	49.7% (43.7, 55.7)	18/114 (15.8%)	-14.3% (-24.4, -4.3)	18/287 (6.3%)	-7.9% (-13.9, -2)	27.6%	3.4% (-18.2, 25.0)

†Unadjusted cluster-level proportions analysed separately at each time point. ‡Change from baseline adjusted for facility size and rural/urban status. All confidence intervals are at 95% confidence level.

Combinations of HIV/STI and MCH services received

In 2009, at least one client in every facility received each type of HIV-MCH integration investigated; that is, one or more clients received integration of HIV-FP (provision and counselling), HIV-ANC, HIV-PNC (for mother or baby), HIV-cervical screening (HIV-CS), and HIV-child health (HIV-CH). Figure 1 shows the proportion of visits in which each service combination was received at each facility. The most common integration in 2009 was HIV with child health services (up to 33% of all visits in Facility G), followed by HIV-ANC and HIV-FP (counselling or provision). Less frequent was integration of HIV services with PNC (a maximum of 6% of visits in Facility C) or cervical screening (maximum 6% of visits in Facility D).

In 2010, integration of HIV services with the MCH services no longer occurred in every facility. For example, in three facilities there were zero visits in which integration of HIV services and family planning occurred; in one intervention and all comparison facilities there was no integration of HIV services and cervical screening services; and in two comparison sites, there were no cases of HIV-ANC and HIV-PNC integration . Excluding the latter two sites, integration of HIV-ANC was the most common type of integration in 2010. Between 2009 and 2012, HIV integration with FP counselling rose in facilities A, E and F - the same facilities that experienced increases in overall HIV-MCH integration. HIV-FP counselling integration declined in the other facilities, and integration of HIV and PNC services – the focus of the intervention – remained low in all facilities over time.

Receipt of HIV counselling

As a secondary outcome, we hypothesised that HIV counselling would increase in the intervention facilities. Table 2 shows that the proportion of visits in which a client received HIV counselling increased between 2009 and 2012 in two intervention (A,D) and two comparison facilities (E,F), and declined in two intervention sites (Facility C) and two comparison sites (G,H). The absolute numbers of visits that included HIV counselling are presented in Figure 2, which also shows that HIV counselling was more often provided in combination with an MCH service than alone. Specifically, HIV counselling was most often provided together with ANC, FP counselling or child health services (data not shown).

Evidence of an intervention effect

As shown in Table 2 (final column), there was no statistical evidence that integration increased over time in intervention facilities as a group. On average, the intervention facilities provided integrated services in 16 percent of visits in 2009 and 14 percent in both 2010 and 2012. Nor was there statistical evidence that the proportion of visits providing HIV counselling increased in the intervention group (averaging 10% in 2009 and 9% in 2012). In the comparison group, both overall HIV-MCH integration and HIV counselling increased between 2009 and 2012 (by 5 and 13 percentage points) after experiencing a decline in 2010. For these differences, 95% confidence intervals include the null value of zero. Between the intervention and comparison groups, there was no statistical difference in change from baseline levels of HIV-MCH integration or provision of HIV counselling (data not shown).

DISCUSSION

With what we believe are among the most detailed data on HIV-MCH integration in the public sector in Africa, we have been able to assess the extent to which clients are receiving integrated services, and in which combinations over time. The client flow assessments have shown that HIV/STI services (counselling, testing and treatment) are being integrated with a wide range of MCH services, including family planning, ante-natal care, post-natal care, cervical screening and child health services. This is evidence of the capacity to integrate, in large urban facilities as well as small, rural facilities across Swaziland. It also fills a current gap in evidence – regarding the feasibility of integrating HIV services with infant/child health services, and postnatal/postpartum services. A recent systematic review of integration evaluations identified both models as 'inadequately studied' to date.[9]

Nevertheless, integration occurred in a minority of visits and varied considerably across facilities. Furthermore, the level of integration fell in three of the eight facilities between 2009 and 2012. The facility with the highest level of integration in 2009 dropped to the lowest a year later (from 49% to <2%). This may be explained by the existence of an NGO campaign to increase access to ART in the area of that facility during the 2010 assessment, as HIV treatment appears to have displaced almost all other HIV and MCH services. This suggests that integration can be susceptible to vertical programmes or competing priorities, particularly in smaller facilities where the 2010 declines in integration were steepest.

It is also possible that integration declined in settings where clients did not need HIV services with every visit. The CFA did not capture clients' history or need for such services, and thus we

cannot interpret observed changes in their provision. For this reason we were particularly interested in the provision of HIV counselling, which can be promoted regardless of need for testing or treatment. HIV counselling rose in two intervention and two comparison facilities. In the three sites where HIV-MCH integration rose, this appeared to be driven by an increase in HIV counselling. That HIV counselling was most often provided with an MCH service rather than alone suggests it has arole to play in scaling up integration, but requires a concerted effort to sustain its provision.

The most common form of integration observed was between HIV services and child health, followed by ANC and FP. These services may offer the best opportunities for integration with HIV, given most women attended for child health, ANC and FP services. This is particularly encouraging in light of a recent review concluding that uptake of PMTCT in sub-Saharan Africa is inadequate, but improves with an integrated family-centred approach, for example, if HIV treatment is provided at antenatal clinics.[7]

Less common was integration of HIV/STI with PNC or cervical screening, most likely due to the lower number of clients receiving PNC and cervical screening relative to other services (or PNC clients may have received HIV/STI testing in recent ANC visits). This suggests that potential effectiveness of the Integra Initiative – which focuses on HIV-PNC integration in Swaziland – may be limited until more clients attend for PNC services. And this may require further investment in equipment and training for PNC (as well as cervical screening, as only one facility had the capacity to offer immediate cryotherapy) as well as demand creation to increase service uptake.

The formal comparison of integration by study design (intervention versus comparison sites) showed no statistical difference in HIV-MCH integration over time. Neither was there a meaningful difference in the receipt of HIV counselling in the intervention group over time.

Limitations and the challenges of embedding research in 'real-world' settings

The observed changes in levels of integration, and absence of an intervention effect, could be due to a number of factors which we were unable to account for given the non-randomised design, as well as challenges implementing the protocol as intended.

With regard to design: in a small country with limited number of facilities, intervention sites could not be matched with similar-sized comparison facilities. This resulted in systematically different groups, with intervention facilities primarily large and urban, and comparison facilities mostly small and rural. Also, the comparison sites – which were determined to have no provision of integration prior to the study in 2008 – were shown via the client flow assessments to be offering integrated HIV-RH services by 2009. Given the heterogeneity, and the focus on a facility-specific outcome in this analysis, we felt it was more informative to compare changes by facility than study design. The wide variation we observed across facilities likely reflects the different capacities and infrastructure available to provide integrated services, i.e., facilities can not follow the same 'blue print' for integration, particularly given the variability in facility size, client volumes and staffing levels among the eight study facilities. Detailed case studies are underway to explore the role of facility differences in greater depth, including intervention

dose and quality, as well as contextual information, to enhance interpretation of the levels and patterns of integration revealed by the client flow assessments.

Some observed changes may also be due to 'seasonal' differences in 2009 and 2010. Coordinating client flow assessments across eight facilities proved logistically challenging and synchronicity was not always achieved as intended. In 2010, most assessments were delayed until the week before Christmas (as compared to November 2009) which may account for the smaller number of clients in most facilities in 2010. This timing may have affected the range of services provided and may account for different patterns of integration. Smaller, rural facilities – where the drops in integration were the steepest - may be impacted more than large, rural sites during such holiday periods.

It is also possible that provision of HIV and MCH services may fluctuate frequently or periodically, in patterns we could not detect from 5-day 'snapshot' assessments (regardless of their specific timing). An early evaluation of CDC's 'patient flow analysis' method, conducted over one day in family planning clinics in Kenya, concluded that: "the 'typical' clinic day does not really exist. The client/patient load and staffing patterns are likely to vary according to many factors: by day of the week, or season of the year, staff vacation or sickness, etc."[14] Assessments were extended to five days in this study, yet, neither does the 'typical' clinic week exist. It may be more informative to monitor over a longer period, for more representative data. However, the 5-day assessments proved challenging and resource-intensive to implement, and longer versions may be prohibitive in many settings. Previous evaluations of patient flow analyses also note that data may not be representative since staff – aware of the

assessment – may try to perform at their best.[14] For these reasons, strengthening routine data collection systems may be preferable, but many existing systems record services individually in separate registers, and are thus unable to document service integration without fundamentally changing the system. It was this barrier that led us to utilise the client flow assessment.

Conclusions

The client flow assessment provided rich detail about the range and combinations of services received by large number of clients. This was valuable for understanding whether and how HIV and MCH services are integrated in practice. The data confirm that, in a context of high HIV prevalence, capacity exists in public sector services for integration of HIV services into MCH care. In particular, ANC, child health and family planning provide promising entry-points for reaching the largest number of women. Sustaining HIV-MCH integration may require concerted effort over time. The study limitations reflect the challenges of embedding rigorous research into existing and diverse facilities (i.e., 'real-world' evaluations), and difficulties in recording the provision of integrated services.

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Author contributions

SM, JK, CW, KC, RN helped to design the data collection. JK managed the data collection. JF and WZ cleaned and managed the datasets. IB and JF led the analysis. All authors provided input into the data interpretation. IB drafted the manuscript. All authors read and commented on a complete draft.

Data sharing

The dataset will be made available via an LSHTM repository upon completion of the Integra Initiative.

Competing interests statement

The authors have declared that no competing interests exist.

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Title

Integration of HIV and maternal health care in a high HIV-prevalence setting: Analysis of client flow data over time in Swaziland

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ABSTRACT

Objective

Maternal and child health (MCH) care may provide an entry point for HIV services in high HIV-prevalence settings. Our objective was to assess integration of HIV with MCH services in public sector facilities in Swaziland.

Design

In 2009, 2010 and 2012, client flow assessments were conducted over five days in the MCH units of eight government facilities, purposively selected as intervention or comparison sites.

Participants

8263 MCH visits with female clients were tracked: 3261 in 2009; 2086 in 2010; and 2916 in 2012.

Intervention

Activities and resources to strengthen integration of HIV services into post-natal care, 2009 - 2010.

Main outcome measures

(1) The proportion of all visits in which an HIV/STI testing, counselling or treatment was received together with an MCH service;

(2) The proportion of all visits in which a client receives HIV counselling.

Results

Across facilities, the proportion of visits in which both HIV/STI and MCH services were received varied considerably, e.g., from 9%-49% in 2009. HIV/STI services were integrated most frequently with child health, ante-natal care (ANC) and family planning – the most common reasons for women's attendance – and least often with post-natal care (PNC) and cervical screening. There was no meaningful difference in integration over time by design group, and considerable heterogeneity across facilities. Receipt of integrated services increased in one intervention and two comparison facilities, where HIV counseling also rose, and fell in one intervention and two comparison facilities.

Conclusions

Provision of HIV/STI services with MCH care occurred at all facilities, yet relatively few women receive integrated services. Increases in integration were driven by increases in HIV counseling while sharp declines in some facilities indicate integration is difficult to sustain. Opportunities for intensifying HIV integration lie with ANC, child health and family planning, while HIV-PNC integration will remain limited until more women attend PNC.

Trial registry and number

Current Controlled Trials NCT01694862

ARTICLE SUMMARY

Article focus

- Maternal health care may provide an entry point for HIV services in high HIV-prevalence settings, yet little is known about actual integration of HIV with maternal care – or how integrated provision can be improved – in public sector facilities.
- Client flow assessments were conducted over five days in MCH units of eight facilities in Swaziland in 2009, 2010 and 2012 (N=8263 visits tracked) to determine the extent to which HIV/STI services were received with MCH services in the same visit, and in what combinations.
- We also assessed whether these outcomes improved with time in facilities which received an intervention designed to strengthen integration of HIV into post-natal care services (the Integra Initiative).

Key messages

- Some provision of HIV/STI services with MCH care occurred at all facilities, indicating a capacity to integrate services in the public sector, yet relatively few women receive integrated services.
- In three facilities, increases in integration over time were driven by increases in HIV counselling. Sharp declines in other facilities suggest integration is difficult to sustain, given frequent staff rotation and vertical HIV treatment campaigns that can divert resources for integration.

- There was no evidence of an increase in integration in three of four intervention facilities. Impact of the intervention to strengthen integration of HIV into PNC will remain limited until more women attend PNC; the best opportunities for scaling up HIV integration may lie with ANC, child health and family planning, given their frequent use.

Strengths and limitations of this study

- The main strength is the scale and novelty of client flow data in public sector facilities in sub-Saharan Africa, offering detailed combinations of services received in every consultation. Such detail is typically unavailable from routine health information systems.
- An important limitation is the logistical challenge in conducting client flow assessments simultaneously across eight government facilities, affecting comparability of data across facilities and time points.

INTRODUCTION

Maternal mortality and HIV have been described as "intersecting epidemics" which must be simultaneously tackled.[1, 2] In the setting for this study – Swaziland, where more than 40% of pregnant women are infected with HIV – HIV is intimately linked with maternal mortality and hinders efforts to lower maternal death rates.[3, 4]

Since the International Conference on Population and Development in 1994, a strong case has been made for integrating HIV services into sexual and reproductive health (SRH) with potential benefits for both clients and facilities.[5, 6] Integration can simultaneously address clients' reproductive health goals and their needs for HIV prevention and treatment and PMTCT.[7] Process evaluations of integrated HIV and family planning (FP) services indicate that facilities can gain by increasing the provision, uptake and efficiency of services while improving client satisfaction and reducing HIV-related stigma in clinics.[8]

More recently, the case for expanding integration of HIV/AIDS services to maternal, neonatal, child health and nutrition, including family planning, is supported in a systematic review which concludes that integration of such services is feasible to implement under certain circumstances.[9] Furthermore, such integration can yield positive effects on the quality of services as well as client outcomes including contraceptive use, antiretroviral therapy in pregnancy, and HIV testing.[9]

Maternal and child health services can thus serve as entry points for HIV prevention, treatment and care, particularly in contexts of high HIV prevalence. Yet little is known about existing

levels of integration, particularly in public sector health facilities, or how provision can be improved and scaled up.[8]

The Integra Initiative is a large-scale non-randomised evaluation designed to assess different models of SRH-HIV integration, including the integration of HIV/STI services with post-natal care (PNC) in Swaziland. Although not a randomised controlled trial, Integra was registered for good practice and transparency (Current Controlled Trials NCT01694862). The specific models of integration ~~– including the use of post-natal care as an entry point for HIV/STI services in Swaziland –~~ and their hypothesised benefits for clients and health care efficiency are detailed in the Integra study protocol.[10] In brief, Integra defines integration as the provision of two or more services in the same visit, with the model in Swaziland focusing on post-natal care as an entry point for HIV/STI counselling, testing and/or treatment services.

As part of the Integra Initiative, this study analysed client flow data collected in eight public sector facilities in Swaziland in 2009, 2010 and 2012, to determine whether clients seeking maternal and child health services (MCH) receive integrated services, and if so, in what combinations of HIV/STI and MCH services.[10] We also sought to understand how the receipt of integrated services differs over time and between facilities which did and did not receive the Integra intervention. We hoped the answers would help identify gaps and opportunities for integrating HIV within maternal health services and achieving universal access to both.

METHODS

Data Collection

As part of Integra's non-randomised design, eight public sector facilities were selected from three of Swaziland's four regions. Four facilities were purposively designated as Intervention facilities (referred to as Facilities A-D), based on their previous participation in an operations research study by Population Council, one of the Integra institutional partners.[11] Four comparison facilities were selected based on their distance from intervention sites (to avoid contamination) and no current (at the time in 2008) provision of integrated HIV-PNC services (Facilities E-H), as determined by discussions with the Ministry of Health and site visits by Population Council.

In the intervention facilities, between October 2009 and December 2010, Integra delivered a programme designed to strengthen and maintain the provision of integrated HIV and PNC services. The intervention components included: (a) a training package to facilitate mentoring of front-line health providers by more experienced providers; (b) job aids to promote integration, including the Balanced Counselling Strategy Plus (BCS+) toolkit containing an algorithm, counselling cards and brochures to support counselling, including HIV service provision, within PNC consultations;[11, 12] and (c) ongoing support to discuss role clarification, organisational change, referral/linkages and management of service statistics.

The client flow assessments (CFAs) comprise one data component of the Integra evaluation. The CFAs were modelled on the Patient Flow Analysis, a method developed by the Centers for Disease Control in the 1970s to track patients' movements through a clinic over one day,[13, 14] and shown to be effective in measuring intervention effectiveness within the context of usual practice.[15] In this context, CFAs were designed to capture service utilisation patterns among

clients seeking MCH services, given that data on integrated service provision were not available from routine clinical data (which collect data on different services in separate registers). Specifically, CFAs were conducted in all study facilities in November 2009, December 2010, and August 2012. Over a period of five days, Monday through Friday, all clients entering the facility for MCH health services were given a client flow form by teams of trained local researchers or service providers. Clients carried the form throughout their visit, and each service provider they saw completed the form in their consultation room/cubicle, indicating session start/end times, the service(s) received by the client and any referrals to other providers.

The first CFA (late November 2009) was conducted soon after the intervention began in October 2009, but before it was fully implemented in any site. For logistical reasons, the client flow assessments could not be conducted in the same week of each year. And specific circumstances in some facilities meant the assessments could not be simultaneous in all eight sites, as the protocol had intended. In some facilities, with the support of facility managers, client flow assessments were conducted for more than the five days intended. To preserve the original protocol design, we restricted this analysis to the first Monday through Friday on which data were collected.

Data analysis

We defined our unit of analysis to be a visit, which comprised all providers seen and services received in the same day for each client, as captured on the client assessment form. Clients were either a single adult or an adult plus a child. We excluded visits of males aged 12 years or

over, to focus on maternal and child health services. The age of 12 was selected as reproductive health services were received by females as young as 12.

The following primary and secondary outcomes were calculated for each facility and time point:

1. Receipt of integrated HIV-MCH services: the proportion of all visits in which a client receives any HIV or STI service, specifically: HIV testing, counselling or treatment; PMTCT; or STI counselling or testing

   and

   any of the following MCH services: FP counselling or provision; PNC for mother or baby; cervical cancer screening; child health (including weighing and immunisations); and antenatal care (ANC).

   We hypothesised that HIV-MCH integration would increase in facilities which received the Integra intervention.

2. Receipt of HIV counselling: the proportion of all visits in which a client receives HIV counselling.

   We hypothesised that HIV counselling would increase as a result of the Integra intervention, regardless of women's need for HIV testing or treatment which are not constant (medical histories, including the need for testing or treatment, were not captured on the CFA form).

We also sought to describe which MCH services were most commonly combined with HIV/STI services, by calculating the percentage of visits in which an HIV/STI service was combined with

each type of MCH service. We examined the change over time in the proportion of visits receiving integrated HIV/STI and MCH services (primary outcome) and HIV counselling (secondary outcome) separately for each facility. We used the 95% confidence interval around the difference (in the 2010 and 2012 proportions compared to 2009) as an indication of whether the observed change was due to chance (if it included the null value of zero).

To examine differences in the key outcomes by design group, we calculated the risk difference in 2010 and 2012 (each compared to 2009) for intervention versus comparison facilities for both the primary and secondary outcomes using a two-stage approach. In the first stage we estimated facility-level residuals by fitting a logistic regression model and including terms to adjust for baseline value (corresponding proportion of visits in 2009), average annual client load (<10000, 10000+), and rural/urban status. Difference residuals were then obtained as the difference between the observed and predicted values (divided by facility size). In the second stage we analysed the facility-level residuals, based on the assumption that in the absence of any intervention effect the residuals should be distributed normally with no systematic difference between the intervention and comparison arms. Difference residuals were analysed using linear regression including an interaction term representing the difference in 'change from baseline' between the design groups.

Ethics Statement

Ethics approval for the client flow assessments was obtained from the Swaziland Scientific Review Board, the London School of Hygiene & Tropical Medicine and the Population Council Institutional Review Board.

RESULTS

Across eight facilities, 3261 visits were tracked in November 2009, 2086 visits in December 2010, and 2916 in August 2012. Table 1 presents general characteristics of the visits and facilities. Additional details about each facility are provided in Supplementary Table 1. Overall, about half of the visits included an adult female and child (under 12 years), versus an adult client only, although this proportion varied across facilities (range: 28%-95%). In almost all facilities, clients received on average more than one service during their visit, with many receiving two or more. Each year, approximately eight percent of clients did not receive any service or referral during their visit, with the highest proportions in the facilities with highest client load (e.g., 18% of clients in Facility B and 31% in Facility D in 2010). In all facilities, and in both years, child health services were either the first or second most common service received. Family planning counselling or provision, and ante-natal care, were among the top three services for most facilities. Across facilities, the least common services received were post-natal care and cervical screening (See Supplementary Table 2).

Table 1. Characteristics of the facilities, visits and services tracked in 2009, 2010 and 2012

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	590	475	532	855	263	408	211	184	241	753	411	607
Client category												
Adult (12+ years) only	395 (66.9%)	196 (41.3%)	211 (39.7%)	443 (51.8%)	153 (58.2%)	172 (42.2%)	144 (68.2%)	87 (47.3%)	82 (34%)	310 (41.2%)	197 (47.9%)	408 (67.2%)
Adult + child	176 (29.8%)	278 (58.5%)	320 (60.2%)	153 (17.9%)	109 (41.4%)	236 (57.8%)	64 (30.3%)	97 (52.7%)	156 (64.7%)	93 (12.4%)	213 (51.8%)	198 (32.6%)
Adult age												
Mean [sd]	26.2 [6.4]	26.2 [7.2]	26.3 [6.5]	26.8 [8.2]	27 [7.2]	26.6 [7.3]	28.5 [8.4]	26.8 [8]	27.7 [8.5]	27.6 [7.4]	27.3 [8.4]	31.3 [10.2]
Missing	9 (1.5%)	258 (54.3%)	17 (3.2%)	357 (41.8%)	40 (15.2%)	13 (3.2%)	2 (.9%)	2 (1.1%)	1 (.4%)	382 (50.7%)	165 (40.1%)	12 (2%)
Services received per visit												
None	37 (6.3%)	24 (5.1%)	88 (16.5%)	134 (15.7%)	47 (17.9%)	23 (5.6%)	11 (5.2%)	6 (3.3%)	32 (13.3%)	93 (12.4%)	129 (31.4%)	29 (4.8%)
One	319 (54.1%)	106 (22.3%)	192 (36.1%)	479 (56%)	145 (55.1%)	208 (51%)	47 (22.3%)	57 (31%)	114 (47.3%)	246 (32.7%)	135 (32.8%)	238 (39.2%)
Two or more	234 (39.7%)	345 (72.6%)	252 (47.4%)	242 (28.3%)	71 (27%)	177 (43.4%)	153 (72.5%)	121 (65.8%)	95 (39.4%)	414 (55%)	147 (35.8%)	340 (56%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.3]	2.5 [1.4]	2.6 [2]	1.6 [1.1]	1.4 [.8]	2 [1.6]	2.6 [1.7]	2 [1]	1.9 [1.3]	2.1 [1.2]	2 [1.3]	2 [1.3]
Mean [sd] providers seen	1.3 [.5]	1.5 [.5]	1.6 [.9]	1.2 [.4]	1 [.2]	1.4 [.7]	1.3 [.5]	1.1 [.4]	1.3 [.5]	1.5 [.7]	1.5 [.7]	1.1 [.3]
Visits where no services were either referred or received	36 (6.1%)	22 (4.6%)	88 (16.5%)	112 (13.1%)	47 (17.9%)	15 (3.7%)	7 (3.3%)	6 (3.3%)	16 (6.6%)	81 (10.8%)	69 (16.8%)	29 (4.8%)
Average annual client load*		32,321			65,794			9,974			40,485	
Setting (urban/rural)		Urban			Urban			Peri-urban			Urban	

Comparison	Facility E			Facility F			Facility G			Facility H		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
Visits tracked	220	215	380	317	333	347	146	170	114	169	35	287
Client category												
Adult (12+ years) only	131 (59.5%)	72 (33.5%)	234 (61.6%)	194 (61.2%)	183 (55%)	154 (44.4%)	74 (50.7%)	106 (62.4%)	47 (41.2%)	110 (65.1%)	2 (5.7%)	178 (62%)
Adult + child	78 (35.5%)	143 (66.5%)	145 (38.2%)	117 (36.9%)	150 (45%)	193 (55.6%)	69 (47.3%)	64 (37.6%)	67 (58.8%)	48 (28.4%)	33 (94.3%)	107 (37.3%)
Adult age												
Mean [sd]	26 [7.5]	26 [5.9]	34.5 [12.6]	26.1 [6.2]	26.4 [6.3]	26.5 [7.4]	27.4 [7.8]	31.4 [10.8]	26.5 [7.2]	25.1 [6]	29.5 [10.6]	30.9 [11.9]
Missing	1 (.5%)	95 (44.2%)	53 (13.9%)	5 (1.6%)	124 (37.2%)	9 (2.6%)	0 (0%)	6 (3.5%)	5 (4.4%)	0 (0%)	33 (94.3%)	67 (23.3%)
Services received per visit												
None	10 (4.5%)	3 (1.4%)	13 (3.4%)	1 (.3%)	5 (1.5%)	8 (2.3%)	11 (7.5%)	6 (3.5%)	14 (12.3%)	31 (18.3%)	0 (0%)	29 (10.1%)
One	99 (45%)	34 (15.8%)	45 (11.8%)	100 (31.5%)	177 (53.2%)	46 (13.3%)	19 (13%)	84 (49.4%)	32 (28.1%)	32 (18.9%)	8 (22.9%)	155 (54%)
Two or more	111 (50.5%)	178 (82.8%)	322 (84.7%)	216 (68.1%)	151 (45.3%)	293 (84.4%)	116 (79.5%)	80 (47.1%)	68 (59.6%)	106 (62.7%)	27 (77.1%)	103 (35.9%)
Visits where ≥1 service received												
Mean [sd] services received	1.8 [1.1]	2.4 [1.1]	3.2 [1.6]	2.3 [1.6]	1.6 [.9]	3.4 [1.6]	3.2 [1.6]	1.6 [.6]	2.6 [1.6]	2.7 [1.6]	2.8 [1.3]	1.8 [1.5]
Mean [sd] providers seen	1.3 [.5]	1.1 [.2]	1.7 [.7]	1.8 [.8]	1 [.2]	1.3 [.6]	1.5 [.5]	1.4 [.6]	1.3 [.6]	1.4 [.6]	1.1 [.3]	1.2 [.5]
Visits where no services were either referred or received	9 (4.1%)	2 (.9%)	12 (3.2%)	1 (.3%)	5 (1.5%)	7 (2%)	11 (7.5%)	5 (2.9%)	8 (7%)	3 (1.8%)	0 (0%)	21 (7.3%)
Average annual client load*		7,736			28,202			9,674			6,959	
Setting (urban/rural)		Rural			Peri-urban			Rural			Rural	

*Annual client load taken from health facility assessments conducted for the Integra Initiative in 2010. All tables are N (%) unless indicated otherwise.

Receipt of integrated HIV-MCH services

There was evidence of HIV-MCH integration at all facilities and time points, although the extent of integration (the proportion of visits in which integrated HIV-MCH services were received) varied by facility: specifically, between 9% and 49% in 2009, 2%-22% in 2010 and 10-44% in 2012 (see Table 2). In the short-term, five facilities experienced declines in integration between 2009 and 2010: by seven and 13 percentage points in two intervention facilities; and by 12, 19 and 48 percentage points in three comparison facilities. In the longer-term, integration increased in one intervention site (Facility A, from 9% in 2009 to 17% of visits in 2012) and two comparison facilities (Facility E, from 11% to 37%; and Facility F, from 16% to 44% in 2012, after experiencing an initial drop to 9% in 2010). Meanwhile, integration fell in one intervention site (Facility C, from 33% to 16%) and two comparison facilities (Facility G, from 49% to 27%; Facility H, from 25% to 14%). Two intervention facilities (B and D) experienced no significant change in HIV-MCH integration between 2009 and 2012.

Table 2. Proportion of visits receiving the primary and secondary outcomes, by facility, year and design group

	Intervention									
	Facility A		Facility B		Facility C		Facility D		All intervention facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	54/590 (9.2%)		83/855 (9.7%)		69/211 (32.7%)		98/753 (13%)		16.1%	
2010	74/475 (15.6%)	6.4% (2.4, 10.4)	6/263 (2.3%)	-7.4% (-10.1, -4.7)	38/184 (20.7%)	-12% (-20.7, -3.4)	73/411 (17.8%)	4.7% (.3, 9.2)	14.1%	-0.8% (-19.3, 17.7)
2012	91/532 (17.1%)	8% (4, 11.9)	40/408 (9.8%)	.1% (-3.4, 3.6)	38/241 (15.8%)	-16.9% (-24.8, -9.1)	78/607 (12.9%)	-.2% (-3.8, 3.4)	13.9%	-8.1% (-27.0, 10.8)
Outcome 2: HIV counselling received										
2009	38/590 (6.4%)		38/855 (4.4%)		56/211 (26.5%)		24/753 (3.2%)		10.2%	
2010	72/475 (15.2%)	8.7% (4.9, 12.5)	20/263 (7.6%)	3.2% (-.3, 6.6)	30/184 (16.3%)	-10.2% (-18.2, -2.2)	54/411 (13.1%)	10% (6.5, 13.5)	13.1%	0.1% (-13.0, 13.2)
2012	81/532 (15.2%)	8.8% (5.1, 12.4)	13/408 (3.2%)	-1.3% (-3.5, .9)	21/241 (8.7%)	-17.8% (-24.8, -10.9	53/607 (8.7%)	5.5% (3, 8.1)	9.0%	-11% (-32.6, 10.6)
	Comparison									
	Facility E		Facility F		Facility G		Facility H		All comparison facilities	
	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome	Change from baseline	Outcome†	Change from baseline‡
Outcome 1: Any HIV/STI service plus any MCH service received in same visit										
2009	24/220 (10.9%)		52/317 (16.4%)		72/146 (49.3%)		42/169 (24.9%)		25.4%	
2010	57/215 (26.5%)	15.6% (8.4, 22.8)	30/333 (9%)	-7.4% (-12.5, -2.3)	6/170 (3.5%)	-45.8% (-54.4, -37.2	5/35 (14.3%)	-10.6% (-23.9, 2.7)	13.3%	-10.8% (-29.2, 7.7)
2012	141/380 (37.1%)	26.2% (19.8, 32.6)	154/347 (44.4%)	28% (21.3, 34.6)	31/114 (27.2%)	-22.1% (-33.6, -10.6	39/287 (13.6%)	-11.3% (-18.9, -3.6)	30.6%	0.6% (-19.5, 18.2)
Outcome 2: HIV counselling received										
2009	10/220 (4.5%)		27/317 (8.5%)		44/146 (30.1%)		24/169 (14.2%)		14.4%	
2010	29/215 (13.5%)	8.9% (3.6, 14.3)	13/333 (3.9%)	-4.6% (-8.3, -.9)	4/170 (2.4%)	-27.8% (-35.6, -20)	3/35 (8.6%)	-5.6% (-16.3, 5)	7.1%	-10.1% (-23.1, 3.0)
2012	114/380 (30%)	25.5% (20.1, 30.8)	202/347 (58.2%)	49.7% (43.7, 55.7)	18/114 (15.8%)	-14.3% (-24.4, -4.3)	18/287 (6.3%)	-7.9% (-13.9, -2)	27.6%	3.4% (-18.2, 25.0)

†Unadjusted cluster-level proportions analysed separately at each time point. ‡Change from baseline adjusted for facility size and rural/urban status. All confidence intervals are at 95% confidence level.

Combinations of HIV/STI and MCH services received

In 2009, at least one client in every facility received each type of HIV-MCH integration investigated; that is, one or more clients received integration of HIV-FP (provision and counselling), HIV-ANC, HIV-PNC (for mother or baby), HIV-cervical screening (HIV-CS), and HIV-child health (HIV-CH). Figure 1 shows the proportion of visits in which each service combination was received at each facility. The most common integration in 2009 was HIV with child health services (up to 33% of all visits in Facility G), followed by HIV-ANC and HIV-FP (counselling or provision). Less frequent was integration of HIV services with PNC (a maximum of 6% of visits in Facility C) or cervical screening (maximum 6% of visits in Facility D).

In 2010, integration of HIV services with the MCH services no longer occurred in every facility. For example, in three facilities there were zero visits in which integration of HIV services and family planning occurred; in one intervention and all comparison facilities there was no integration of HIV services and cervical screening services; and in two comparison sites, there were no cases of HIV-ANC and HIV-PNC integration . Excluding the latter two sites, integration of HIV-ANC was the most common type of integration in 2010. Between 2009 and 2012, HIV integration with FP counselling rose in facilities A, E and F - the same facilities that experienced increases in overall HIV-MCH integration. HIV-FP counselling integration declined in the other facilities, and integration of HIV and PNC services – the focus of the intervention – remained low in all facilities over time.

Receipt of HIV counselling

As a secondary outcome, we hypothesised that HIV counselling would increase in the intervention facilities. Table 2 shows that the proportion of visits in which a client received HIV counselling increased between 2009 and 2012 in two intervention (A,D) and two comparison facilities (E,F), and declined in two intervention sites (Facility C) and two comparison sites (G,H). The absolute numbers of visits that included HIV counselling are presented in Figure 2, which also shows that HIV counselling was more often provided in combination with an MCH service than alone. Specifically, HIV counselling was most often provided together with ANC, FP counselling or child health services (data not shown).

Evidence of an intervention effect

As shown in Table 2 (final column), there was no statistical evidence that integration increased over time in intervention facilities as a group. On average, the intervention facilities provided integrated services in 16 percent of visits in 2009 and 14 percent in both 2010 and 2012. Nor was there statistical evidence that the proportion of visits providing HIV counselling increased in the intervention group (averaging 10% in 2009 and 9% in 2012). In the comparison group, both overall HIV-MCH integration and HIV counselling increased between 2009 and 2012 (by 5 and 13 percentage points) after experiencing a decline in 2010. For these differences, 95% confidence intervals include the null value of zero. Between the intervention and comparison groups, there was no statistical difference in change from baseline levels of HIV-MCH integration or provision of HIV counselling (data not shown).

DISCUSSION

With what we believe are among the most detailed data on HIV-MCH integration in the public sector in Africa, we have been able to assess the extent to which clients are receiving integrated services, and in which combinations over time. The client flow assessments have shown that HIV/STI services (counselling, testing and treatment) are being integrated with a wide range of MCH services, including family planning, ante-natal care, post-natal care, cervical screening and child health services. This is evidence of the capacity to integrate, in large urban facilities as well as small, rural facilities across Swaziland. It also fills a current gap in evidence – regarding the feasibility of integrating HIV services with infant/child health services, and postnatal/postpartum services. A recent systematic review of integration evaluations identified both models as 'inadequately studied' to date.[9]

Nevertheless, integration occurred in a minority of visits and varied considerably across facilities. Furthermore, the level of integration fell in three of the eight facilities between 2009 and 2012. The facility with the highest level of integration in 2009 dropped to the lowest a year later (from 49% to <2%). This may be explained by the existence of an NGO campaign to increase access to ART in the area of that facility during the 2010 assessment, as HIV treatment appears to have displaced almost all other HIV and MCH services. This suggests that integration can be susceptible to vertical programmes or competing priorities, particularly in smaller facilities where the 2010 declines in integration were steepest.

It is also possible that integration declined in settings where clients did not need HIV services with every visit. The CFA did not capture clients' history or need for such services, and thus we

cannot interpret observed changes in their provision. For this reason we were particularly interested in the provision of HIV counselling, which can be promoted regardless of need for testing or treatment. HIV counselling rose in two intervention and two comparison facilities. In the three sites where HIV-MCH integration rose, this appeared to be driven by an increase in HIV counselling. That HIV counselling was most often provided with an MCH service rather than alone suggests it has arole to play in scaling up integration, but requires a concerted effort to sustain its provision.

The most common form of integration observed was between HIV services and child health, followed by ANC and FP. These services may offer the best opportunities for integration with HIV, given most women attended for child health, ANC and FP services. This is particularly encouraging in light of a recent review concluding that uptake of PMTCT in sub-Saharan Africa is inadequate, but improves with an integrated family-centred approach, for example, if HIV treatment is provided at antenatal clinics.[7]

Less common was integration of HIV/STI with PNC or cervical screening, most likely due to the lower number of clients receiving PNC and cervical screening relative to other services (or PNC clients may have received HIV/STI testing in recent ANC visits). This suggests that potential effectiveness of the Integra Initiative – which focuses on HIV-PNC integration in Swaziland – may be limited until more clients attend for PNC services. And this may require further investment in equipment and training for PNC (as well as cervical screening, as only one facility had the capacity to offer immediate cryotherapy) as well as demand creation to increase service uptake.

The formal comparison of integration by study design (intervention versus comparison sites) showed no statistical difference in HIV-MCH integration over time. Neither was there a meaningful difference in the receipt of HIV counselling in the intervention group over time.

Limitations and the challenges of embedding research in 'real-world' settings

The observed changes in levels of integration, and absence of an intervention effect, could be due to a number of factors which we were unable to account for given the non-randomised design, as well as challenges implementing the protocol as intended.

With regard to design: in a small country with limited number of facilities, intervention sites could not be matched with similar-sized comparison facilities. This resulted in systematically different groups, with intervention facilities primarily large and urban, and comparison facilities mostly small and rural. Also, the comparison sites – which were determined to have no provision of integration prior to the study in 2008 – were shown via the client flow assessments to be offering integrated HIV-RH services by 2009. Given the ~~resulting~~ heterogeneity, and the focus on a facility-specific outcome in this analysis, we felt it was more informative to compare changes by facility than study design. The wide variation we observed across facilities likely reflects the different capacities and infrastructure available to provide integrated services, i.e., facilities can not follow the same 'blue print' for integration, particularly given the variability in facility size, client volumes and staffing levels among the eight study facilities. Detailed case studies are underway to explore the role of facility differences in greater depth, including

intervention dose and quality, as well as contextual information, to enhance interpretation of the levels and patterns of integration revealed by the client flow assessments.

Some observed changes may also be due to 'seasonal' differences in 2009 and 2010. Coordinating client flow assessments across eight facilities proved logistically challenging and synchronicity was not always achieved as intended. In 2010, most assessments were delayed until the week before Christmas (as compared to November 2009) which may account for the smaller number of clients in most facilities in 2010. This timing may have affected the range of services provided and may account for different patterns of integration. Smaller, rural facilities – where the drops in integration were the steepest - may be impacted more than large, rural sites during such holiday periods.

It is also possible that provision of HIV and MCH services may fluctuate frequently or periodically, in patterns we could not detect from 5-day 'snapshot' assessments (regardless of their specific timing). An early evaluation of CDC's 'patient flow analysis' method, conducted over one day in family planning clinics in Kenya, concluded that: "the 'typical' clinic day does not really exist. The client/patient load and staffing patterns are likely to vary according to many factors: by day of the week, or season of the year, staff vacation or sickness, etc."[14] Assessments were extended to five days in this study, yet, neither does the 'typical' clinic week exist. It may be more informative to monitor over a longer period, for more representative data. However, the 5-day assessments proved challenging and resource-intensive to implement, and longer versions may be prohibitive in many settings. Previous evaluations of patient flow analyses also note that data may not be representative since staff – aware of the

assessment – may try to perform at their best.[14] For these reasons, strengthening routine data collection systems may be preferable, but many existing systems record services individually in separate registers, and are thus unable to document service integration without fundamentally changing the system. It was this barrier that led us to utilise the client flow assessment.

Conclusions

The client flow assessment provided rich detail about the range and combinations of services received by large number of clients. This was valuable for understanding whether and how HIV and MCH services are integrated in practice. The data confirm that, in a context of high HIV prevalence, capacity exists in public sector services for integration of HIV services into MCH care. In particular, ANC, child health and family planning provide promising entry-points for reaching the largest number of women. Sustaining HIV-MCH integration may require concerted effort over time. The study limitations reflect the challenges of embedding rigorous research into existing and diverse facilities (i.e., 'real-world' evaluations), and difficulties in recording the provision of integrated services.

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Author contributions

SM, JK, CW, KC, RN helped to design the data collection. JK managed the data collection. JF and WZ cleaned and managed the datasets. IB and JF led the analysis. All authors provided input into the data interpretation. IB drafted the manuscript. All authors read and commented on a complete draft.

Data sharing

The dataset will be made available via an LSHTM repository upon completion of the Integra Initiative.

Competing interests statement

The authors have declared that no competing interests exist.

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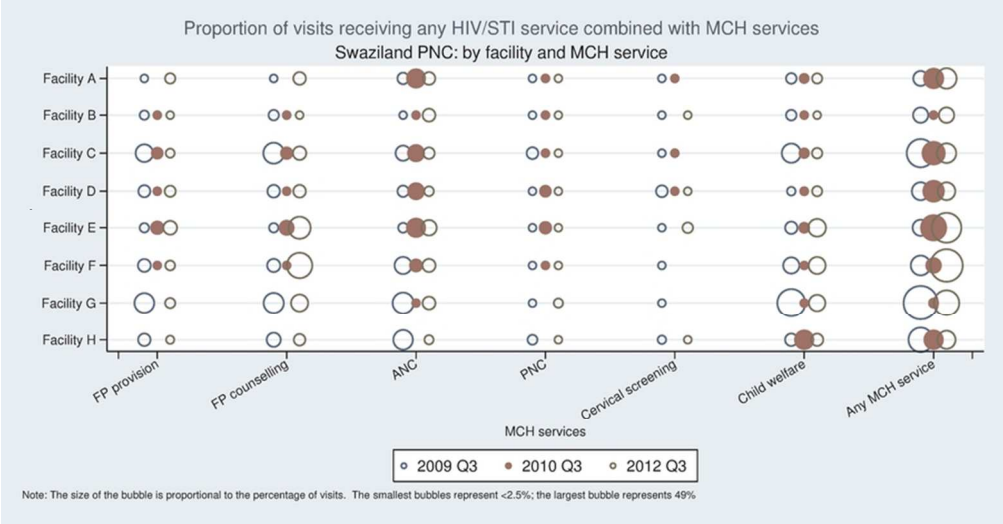

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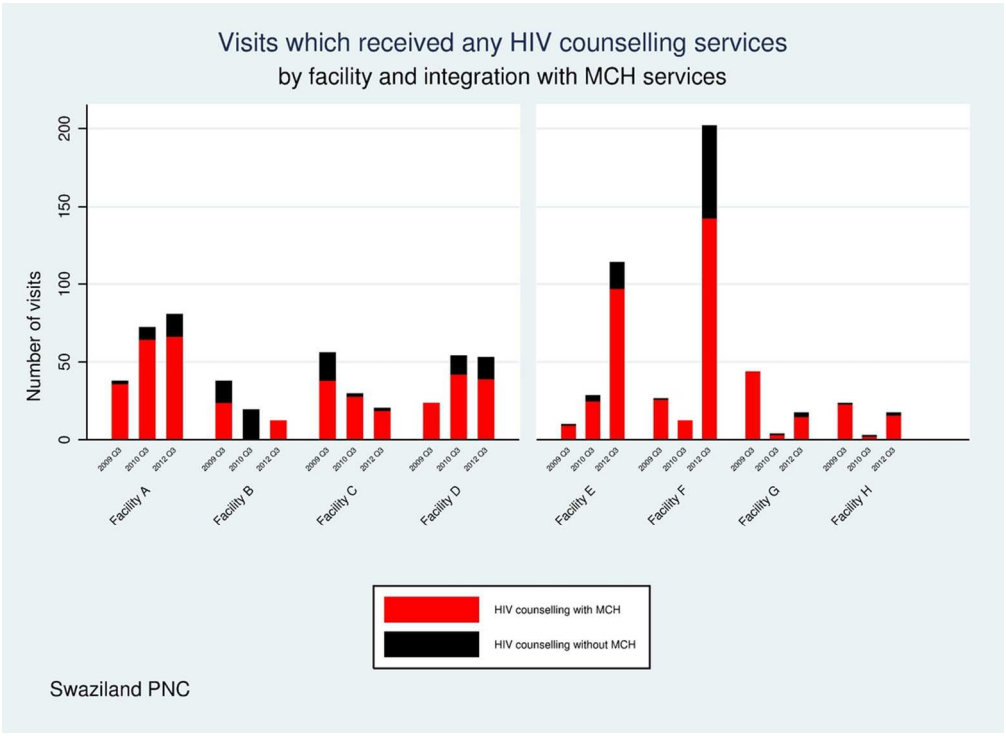

Figure 2. Number of visits receiving any HIV counselling services, by facility and integration with MCH services
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Supplementary Table 1. Characteristics of the facilities *

Intervention	Facility A	Facility B	Facility C	Facility D
Type of facility	Public Health Unit	Public Health Unit	Hospital	Hospital
Inpatient beds (#)	0	0	200	350
Outpatient visits per year (#)	44,280	43,671	22,820	219,943
Staff (#) ^				
Clinical	22	20	43	214
Technical	2	1	93	58
Admin/management	2	1	3	5
Services provided	FP; PNC; STI management; general SRH counselling; Ca Cx screening; PITC; ART clinic; CD4 count (samples drawn in ART unit). ART services since March 2011	Static services: Tx of opportunistic infections, ART initiation & refills to HIV-positive PNC & ANC clients & families; ANC; FP; PNC; dental services; curatives; Lab services; child welfare clinic; STI management. Outreach clinics provide child welfare, PNC, FP, curatives, STI treatment	FP; PNC; Ca Cx Screening; PMTCT; STI management; General SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU and ART unit); TB screening & treatment (TB unit)	FP; PNC; Ca Cx Screening; PMTCT; STI management; general SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU & ART unit); TB screening & treatment (TB unit)

Comparison	Facility E	Facility F	Facility G	Facility H
Type of facility	Health Centre	Health Centre	Health Centre	Health Centre
Inpatient beds (#)	35	40	0	0
Outpatient visits per year (#)	12,770	63,809	25,513	24,062
Staff (#)				
Clinical	33	50	28	214
Technical	17	23	11	58
Admin/management	2	27	12	5
Services provided	FP; PNC; STI management; Maternity/Gynae; General SRH counselling; Ca CX Screening (clients referred); PITC; ART clinic; CD4 count (samples drawn in PHU, ART & TB units); TB screening & treatment (TB unit)	FP; PNC; PMTCT; STI management; general SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU & ART unit); TB screening & treatment (TB unit)	FP; PNC; PMTCT; STI management; general SRH counselling; PITC; ART clinic; VCT (since June 2011; CD4 count (samples drawn in PHU and ART unit); TB screening & treatment (TB unit)	FP; PNC; PMTCT; STI management; general SRH counselling; PITC; VCT; ART clinic; CD4 count (samples drawn in PHU & ART unit); TB screening & treatment (TB unit)

*Taken from health facility assessments conducted for the Integra Initiative in 2010

^ Clinical staff include staff nurses, nursing assistants, doctors, dentists, paramedics and medical officers ; Technical staff include radiographers, medical technologists, lab technicians/assistants, phlebotomists, pharmacists, environmental health officers, mentor mothers, expert clients, cough officers, lay counsellors; Administrative staff include managers, senior nurses, matrons, health administrators, data clerks, orderlies.

Supplementary Table 21. Proportion of visits in which key HIV/STI and MCH services were received, by facility and year

Intervention	Facility A			Facility B			Facility C			Facility D		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
N	590	475	532	855	263	408	211	184	241	753	411	607
HIV/STI services received												
HIV testing	40 (6.8%)	39 (8.2%)	125 (23.5%)	20 (2.3%)	6 (2.3%)	14 (3.4%)	13 (6.2%)	8 (4.3%)	15 (6.2%)	10 (1.3%)	29 (7.1%)	33 (5.4%)
HIV counselling	38 (6.4%)	72 (15.2%)	81 (15.2%)	38 (4.4%)	20 (7.6%)	13 (3.2%)	56 (26.5%)	30 (16.3%)	21 (8.7%)	24 (3.2%)	54 (13.1%)	53 (8.7%)
HIV treatment	4 (.7%)	9 (1.9%)	14 (2.6%)	139 (16.3%)	21 (8%)	70 (17.2%)	29 (13.7%)	10 (5.4%)	108 (44.8%)	65 (8.6%)	1 (.2%)	78 (12.9%)
PMTCT	0 (0%)	30 (6.3%)	27 (5.1%)	0 (0%)	1 (.4%)	24 (5.9%)	0 (0%)	7 (3.8%)	7 (2.9%)	0 (0%)	71 (17.3%)	28 (4.6%)
STI counselling & testing	13 (2.2%)	0 (0%)	49 (9.2%)	65 (7.6%)	49 (18.6%)	9 (2.2%)	46 (21.8%)	1 (.5%)	5 (2.1%)	59 (7.8%)	5 (1.2%)	28 (4.6%)
Any HIV/STI service	57 (9.7%)	83 (17.5%)	202 (38%)	218 (25.5%)	74 (28.1%)	109 (26.7%)	92 (43.6%)	47 (25.5%)	135 (56%)	138 (18.3%)	87 (21.2%)	159 (26.2%)
MCH services received												
Family planning provision	176 (29.8%)	97 (20.4%)	105 (19.7%)	147 (17.2%)	38 (14.4%)	63 (15.4%)	56 (26.5%)	46 (25%)	18 (7.5%)	67 (8.9%)	40 (9.7%)	100 (16.5%)
Family planning counselling	65 (11%)	44 (9.3%)	93 (17.5%)	84 (9.8%)	9 (3.4%)	52 (12.7%)	70 (33.2%)	19 (10.3%)	33 (13.7%)	77 (10.2%)	40 (9.7%)	130 (21.4%)
ANC	145 (24.6%)	74 (15.6%)	49 (9.2%)	102 (11.9%)	19 (7.2%)	78 (19.1%)	49 (23.2%)	46 (25%)	20 (8.3%)	322 (42.8%)	48 (11.7%)	86 (14.2%)
PNC (mother or baby)	53 (9%)	35 (7.4%)	11 (2.1%)	32 (3.7%)	10 (3.8%)	16 (3.9%)	16 (7.6%)	9 (4.9%)	10 (4.1%)	54 (7.2%)	23 (5.6%)	28 (4.6%)
Cervical screen	2 (.3%)	1 (.2%)	3 (.6%)	8 (.9%)	0 (0%)	2 (.5%)	3 (1.4%)	1 (.5%)	0 (0%)	348 (46.2%)	1 (.2%)	11 (1.8%)
Child health (incl. Immunization)	320 (54.2%)	277 (58.3%)	174 (32.7%)	319 (37.3%)	90 (34.2%)	157 (38.5%)	93 (44.1%)	81 (44%)	47 (19.5%)	155 (20.6%)	128 (31.1%)	268 (44.2%)
Other reproductive health service	1 (.2%)	0 (0%)	1 (.2%)	11 (1.3%)	7 (2.7%)	4 (1%)	2 (.9%)	1 (.5%)	5 (2.1%)	58 (7.7%)	27 (6.6%)	0 (0%)
Any MCH service	550 (93.2%)	441 (92.8%)	326 (61.3%)	543 (63.5%)	147 (55.9%)	313 (76.7%)	175 (82.9%)	167 (90.8%)	106 (44%)	610 (81%)	256 (62.3%)	476 (78.4%)
Comparison	**Facility E**			**Facility F**			**Facility G**			**Facility H**		
	2009	2010	2012	2009	2010	2012	2009	2010	2012	2009	2010	2012
N	220	215	380	317	333	347	146	170	114	169	35	287
HIV/STI services received												
HIV testing	14 (6.4%)	16 (7.4%)	33 (8.7%)	14 (4.4%)	4 (1.2%)	16 (4.6%)	19 (13%)	0 (0%)	16 (14%)	22 (13%)	0 (0%)	6 (2.1%)
HIV counselling	10 (4.5%)	29 (13.5%)	114 (30%)	27 (8.5%)	13 (3.9%)	202 (58.2%)	44 (30.1%)	4 (2.4%)	18 (15.8%)	24 (14.2%)	3 (8.6%)	18 (6.3%)
HIV treatment	9 (4.1%)	12 (5.6%)	31 (8.2%)	18 (5.7%)	7 (2.1%)	173 (49.9%)	41 (28.1%)	78 (45.9%)	48 (42.1%)	4 (2.4%)	0 (0%)	96 (33.4%)
PMTCT	0 (0%)	28 (13%)	50 (13.2%)	0 (0%)	18 (5.4%)	15 (4.3%)	0 (0%)	9 (5.3%)	7 (6.1%)	0 (0%)	6 (17.1%)	16 (5.6%)
STI counselling & testing	8 (3.6%)	13 (6%)	43 (11.3%)	24 (7.6%)	0 (0%)	101 (29.1%)	15 (10.3%)	0 (0%)	3 (2.6%)	25 (14.8%)	0 (0%)	7 (2.4%)
Any HIV/STI service	30 (13.6%)	64 (29.8%)	176 (46.3%)	57 (18%)	36 (10.8%)	253 (72.9%)	74 (50.7%)	91 (53.5%)	69 (60.5%)	45 (26.6%)	7 (20%)	123 (42.9%)
MCH services received												
Family planning provision	52 (23.6%)	57 (26.5%)	100 (26.3%)	73 (23%)	128 (38.4%)	39 (11.2%)	47 (32.2%)	12 (7.1%)	17 (14.9%)	43 (25.4%)	8 (22.9%)	32 (11.1%)
Family planning counselling	23 (10.5%)	64 (29.8%)	148 (38.9%)	41 (12.9%)	38 (11.4%)	117 (33.7%)	44 (30.1%)	6 (3.5%)	23 (20.2%)	43 (25.4%)	7 (20%)	50 (17.4%)
ANC	45 (20.5%)	41 (19.1%)	58 (15.3%)	199 (62.8%)	83 (24.9%)	40 (11.5%)	49 (33.6%)	7 (4.1%)	13 (11.4%)	49 (29%)	0 (0%)	21 (7.3%)
PNC (mother or baby)	2 (.9%)	17 (7.9%)	14 (3.7%)	17 (5.4%)	20 (6%)	3 (.9%)	5 (3.4%)	1 (.6%)	9 (7.9%)	11 (6.5%)	1 (2.9%)	16 (5.6%)
Cervical screen	2 (.9%)	0 (0%)	23 (6.1%)	3 (.9%)	0 (0%)	0 (0%)	2 (1.4%)	0 (0%)	0 (0%)	6 (3.6%)	0 (0%)	2 (.7%)
Child health (incl. Immunization)	135 (61.4%)	102 (47.4%)	118 (31.1%)	198 (62.5%)	111 (33.3%)	84 (24.2%)	81 (55.5%)	43 (25.3%)	22 (19.3%)	62 (36.7%)	31 (88.6%)	89 (31%)
Other reproductive health service	0 (0%)	0 (0%)	3 (.8%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	2 (1.8%)	1 (.6%)	0 (0%)	3 (1%)
Any MCH service	204 (92.7%)	204 (94.9%)	312 (82.1%)	311 (98.1%)	322 (96.7%)	238 (68.6%)	133 (91.1%)	63 (37.1%)	61 (53.5%)	133 (78.7%)	33 (94.3%)	165 (57.5%)