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Performance-based incentives may be appropriate to address challenges to delivery of prevention of vertical transmission of HIV services in rural Mozambique: a qualitative investigation

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Abstract

Background: Performance-based incentives (PBIs) have garnered global attention as a promising strategy to improve healthcare delivery to vulnerable populations. However, literature gaps in the context in which an intervention is implemented and how the PBIs were developed exist. Therefore, we (1) characterized the barriers and promoters to prevention of vertical transmission of HIV (PVT) service delivery in rural Mozambique, where the vertical transmission rate is 12 %, and (2) assessed the appropriateness for a PBI's intervention and application to PVT.

Methods: We conducted 24 semi-structured interviews with nurses, volunteers, community health workers, and traditional birth attendants about the barriers and promoters they experienced delivering PVT services. We then explored emergent themes in subsequent focus group discussions ($n = 7$, total participants $N = 92$) and elicited participant perspectives on PBIs. The ecological motivation-opportunity-ability framework guided our iterative data collection and thematic analysis processes.

Results: The interviews revealed that while all health worker cadres were motivated intrinsically and by social recognition, they were dissatisfied with low and late remuneration. Facility-based staff were challenged by factors across the rest of the ecological levels, primarily in the opportunity domain, including the following: poor referral and record systems (work mandate), high workload, stock-outs, poor infrastructure (facility environment), and delays in obtaining patient results and donor payment discrepancies (administrative). Community-based cadres' opportunity challenges included lack of supplies, distance (work environment), lack of incorporation into the health system (administration), and ability challenges of incorrect knowledge (health worker). PBIs based on social recognition and that enable action on intrinsic motivation through training, supervision, and collaboration were thought to have the most potential for targeting improvements in record and referral systems and better integrating community-based health workers into the health system. Concerns about the implementation of incentives included neglect of non-incentivized tasks and distorted motivation among colleagues.

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Conclusions: We found that highly motivated health workers encountered severe opportunity challenges in their PVT mandate. PBIs have the potential to address key barriers that facility- and community-based health workers encounter when delivering PVT services, specifically by building upon existing intrinsic motivation and leveraging highly valued social recognition. We recommend a controlled intervention to monitor incentives' effects on worker motivation and non-incentivized tasks to generate insights about the feasibility of PBIs to improve the delivery of PVT services.

Keywords: Prevention of mother-to-child transmission of HIV, Performance-based incentives, Maternal and child health nurses, Community health workers, Traditional birth attendants, Motivation, Health systems, Mozambique

Background

The implementation of evidence-based biomedical practices and policies over the past decade has demonstrated potential to significantly reduce rates of vertical transmission of HIV to as low as 1–2 % [1]. The continuum of care to prevent vertical transmission of HIV (PVT) includes maternal HIV testing, prenatal and postnatal antiretroviral therapy (ART) and prophylaxis, safe birth practices, safe infant and young child feeding, and early infant HIV testing [2]. However, barriers to this cascade contributed to 199 000 infants and young children becoming HIV infected in sub-Saharan Africa in 2013 [3]. There, HIV-infected women experience individual, family, community, health system, and structural barriers that result in their drop-off from each step in the continuum of PVT care [4, 5]. Simultaneously, health workers face challenges that affect their motivation, opportunity, and ability to deliver PVT services [6].

Mozambique experiences significant challenges to both uptake and delivery of PVT services. First, women of reproductive age experience a high prevalence of HIV (16 %), fifth-highest among women aged 15–24 globally [7]. Second, despite significant progress over the past decade, coverage of PVT services remains low: only 42 % of pregnant women received HIV counseling, testing, and test results during antenatal care [8], and 35 % of HIV-exposed infants were HIV tested by 2 months [7]. These drop-offs, and sub-optimal coverage of other PVT services, resulted in 12 % of HIV-exposed Mozambican children becoming infected with HIV in 2013 [9]. Finally, both facility- and community-based health workers deliver PVT services in Mozambique, reflecting the widespread trend of “task shifting,” or movement of tasks from more to less specialized health workers, in HIV care.

Performance-based incentives (PBIs) have been effective in improving uptake and delivery of health services in low-resource settings. On the delivery side, PBIs are the distribution of money or material goods after a performance target has been achieved and aim to counteract weak health system incentives by aligning rewards with health outcomes [10]. Delivery-focused PBIs have increased institutional births and antenatal care

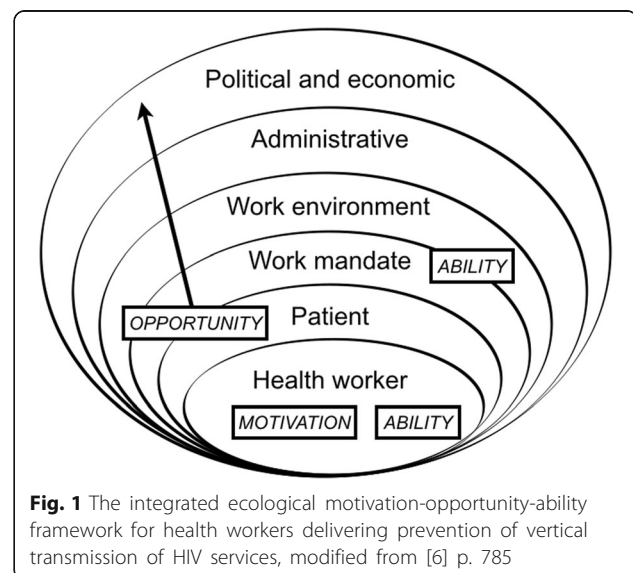
attendance, preventative child visits, and HIV testing in African nations including Rwanda, Nigeria, Tanzania, and Benin [10–15]. A situational analysis recognized PBIs as appropriate and feasible in Mozambique and suggested that PBIs could support task shifting, motivate community health workers, and mitigate health facility challenges to service delivery [16]. Indeed, PBIs were successfully used to achieve process improvements in the Mozambican medical supply chain [17]. However, until recently, PBIs had been underinvestigated in the context of PVT [18].

Therefore, we (1) characterized the barriers and promoters experienced by health workers delivering PVT services in rural Mozambique and (2) assessed the potential for PBIs to support delivery of PVT services.

Methods

Theoretical underpinnings

Two complimentary frameworks were applied to guide the study design and data analysis [6] (Fig. 1). The first was the ecologically embedded determinants of performance research agenda, which is embedded within an ecological framework that places the health worker at the center and moves outwards towards the political and economic environment [19]. The second was the



motivation-opportunity-ability framework, which is grounded in human resources and operations management [20] and posits that three domains are required for optimal worker performance [21]. In integrating these frameworks, we operationalized “motivation” as the individual’s desire and willingness to act. “Opportunity” encompassed the many contextual factors that enable action beyond the individual. “Ability” included the skills and knowledge to execute action and overlaps with both the individual level and more distal levels of the ecological determinants of performance framework [6].

Study setting

Mozambique’s legacy of colonization, war for independence (1964–1974), and civil war (1977–1992) left its health system and infrastructure unprepared for the HIV/AIDS epidemic [22]. Today, Mozambique has only 4 physicians and 41 nurses per 100 000 people, far below the regional average [23]. Task-shifting initiatives such as training mid-level *técnicos de cirurgia* (surgical technicians) have helped address the skilled labor shortage for surgical needs [24] but have not alleviated the workload of nurses and midwives who deliver PVT services, which were integrated into antenatal care at the primary care level and free to patients [25].

We conducted this research in 2012 in a rural district in northern Inhambane Province, where CARE International was the PEPFAR-implementing partner. The district had a population of 56 000, few maintained roads, and irregular public transportation. In 2012, there were approximately 2700 pregnancies in the district, with an estimated 53 % of births occurring at health facilities [26]. HIV prevalence among pregnant women attending antenatal care was 10.5 % [27].

The public health system was comprised of one type III health facility in the district capital, one type III peripheral health facility, and four type II peripheral health facilities. The two physicians for the entire district were based at the type III facility in the district capital. A *técnico* led the largest peripheral health facility and nurses led the others. At the time of the study, the district and large peripheral type III facilities were the only facilities where patients could access ART (when CD4 count \leq 350 cells/mm); only antiretroviral prophylaxis was available at the type II peripheral facilities. There were no private health facilities or physicians. A number of *curandeiros* (traditional healers) practiced in the district.

Four cadres of health workers provided PVT services within the district (Table 1). Maternal and child health nurses provided the majority of clinical PVT services at health facilities. *Activistas*, or community volunteers, provided home care and counseling to individuals living with HIV/AIDS and received supervision and financial

support from CARE International. Community health workers (CHWs) provided a broad portfolio of health services to households within 10 km² of their home [28]. CHWs were trained in late 2011 and began working in early 2012 and received support and supervision from the implementing partner Malaria Consortium in addition to the Ministry of Health [29]. Traditional birth attendants (TBAs) historically assisted with home births but now increasingly focused on referral for health facility deliveries. TBAs were not systematically organized or supervised.

Semi-structured interviews

Participant selection

To characterize health workers’ barriers and promoters (objective 1), we recruited members of the four cadres for semi-structured interviews. Maternal and child health nurses were purposively sampled based on their role and type of health facility (district, large peripheral, small peripheral). Key informants from two *activista* associations identified *activistas*, who were purposively sampled based on level of engagement. CHWs were identified by their district coordinator and were invited to participate when they visited the health facility to stock-up on supplies. A convenience sample of TBAs attending a training jointly facilitated by the district health authority and CARE International was invited to participate. Sample sizes for each cadre were based upon achieving the saturation needed to outline overarching themes [30], with the intent to expound upon these in subsequent focus group discussions.

Data collection

The interview guide contained questions about participants’ experiences delivering care to HIV-infected women and their HIV-exposed children, as well as their perceptions of the barriers and facilitators mothers face in the uptake of PVT services (Additional File 1). The guide was modified for each health worker cadre and pre-tested with the corresponding cadres in a neighboring district.

Two Mozambican research assistants experienced in qualitative research conducted the interviews from September 2012 to January 2013. Interviews were conducted in Xitswa or Portuguese per participant preference and took approximately 60 min. Participants were interviewed in private spaces at health facilities (nurses, *activistas*), in their communities (CHWs), and training site (TBAs).

Focus group discussions

Participant selection

To share, validate, and expound upon early findings from the interviews (objective 1) and assess the appropriateness of PBIs for PVT service delivery (objective 2),

Table 1 Organizational structure and description of key services provided by the four health worker cadres preventing vertical transmission of HIV in rural Mozambique

Cadre	Key services	Organization	Receives supervision	Salary	Supported by
Maternal and child health nurses	Antenatal care, birth, children 0–5 years, family planning, and clinical PVT services	Health facilities	Yes	US\$ 250/month	Ministry of Health, CARE International via PEPFAR
<i>Activistas</i> (community volunteers)	Home-based care, counseling (e.g., treatment adherence, appointment follow-up), linking HIV-infected individuals to clinical care	Association (3 leaders, 20 <i>activistas</i>)	Yes	850 MZN/month (~US\$ 28)	CARE International
Community health workers (CHWs)	Portfolio of health promotion and preventative care (e.g., sanitation and hygiene, malaria, and maternal and child health including breastfeeding and family planning, limited HIV/AIDS), limited curative care	Reports to coordinator at health facility	Yes	1 200 MZN/month (~US\$ 40) ^a	Ministry of Health and Malaria Consortium
Traditional birth attendants (TBAs)	Refer women to health facilities for antenatal care and delivery and occasionally assist in home births	Not formally organized	No	Uncompensated	N/A

^a60 % of the minimum monthly salary, per government recommendations

activistas, TBAs, and an array of facility-based health workers were recruited for focus group discussions. Representatives of each health sector at the district and large peripheral facilities and all staff at the small peripheral health facility were invited to participate because key informants strongly felt that all staff contributed to PVT care. All members of the two *activista* associations were invited to participate. TBAs known to be active in their communities were invited through key informants and snowball recruitment. No focus group was conducted with CHWs because concurrent interviews with HIV-infected mothers did not show women were receiving PVT services from them at that time.

Data collection

We conducted a total of seven focus groups lasting 90–120 min in March 2013. Participants were asked about types of incentives, how goals should be set and assessed, and concerns about implementing PBIs. One focus group was conducted at each of the three health facilities (district type III facility ($n = 12$); peripheral type III facility ($n = 12$); type II ($n = 3$)) in Portuguese. One focus group was conducted with each of the two *activista* associations in Xitswa at their respective meeting locations ($n = 22$ each). A sixth focus group with TBAs ($n = 6$) was conducted in Xitswa at a community meeting location. The final focus group was conducted with representatives from each of the three health facilities and two *activista* associations (total $n = 13$).

Participant observation

The interviews and focus groups were complimented by participant observation primarily conducted at the three health facilities and at *activista* meetings between July 2012 and March 2013. Participant observation at the two type III and one type II facilities was conducted at minimum on a biweekly basis at each facility, during facility

business hours, and included a few facility-wide meetings on strategies for integrated HIV/AIDS case management. Participant observation at *activista* association meetings was conducted once per month. Handwritten notes were recorded and were subsequently typed.

Analysis

The interviews and focus groups were audio recorded and accompanied by detailed handwritten notes. The interviews were transcribed into Portuguese, and the detailed notes from the focus groups were typed in Portuguese with the support of the audio recording. All transcripts were translated into English and were coded by two co-authors using the thematic analysis approach [31]. Interview results were shared with focus group participants to prompt further discussion, creating an iterative analysis process. Participant observation data was used to triangulate themes and validate findings [32].

Results

Roles in the context of PVT

Of the 24 health workers who participated in interviews (Table 2), nurses and *activistas* reported the greatest involvement in PVT. One nurse summarized, “My role is to counsel an HIV-infected woman in a way that she will understand that even if she has HIV, the baby can be born without the virus if she follows the recommendations that we give her” (Female nurse, 3 years of experience). *Activistas* provided in-depth counseling to pregnant women on treatment adherence, inclusive of checking pill bottles and reviewing appointment schedules, and counseled on infant and young child feeding and family planning. CHWs reported that HIV services were a small component of their portfolio and mainly advised uptake facility-based care, adherence to treatment regimens, infant feeding, and family planning. All TBAs advised women on family planning, and most advised on breastfeeding, HIV testing, and

Table 2 Characteristics of the Mozambican health workers who participated in semi-structured interviews, by cadre ($n = 24$)

Characteristics	Facility-based	Community-based		
	Maternal and child health nurses ($n = 4$)	<i>Activistas</i> ($n = 6$)	Community health workers ($n = 6$)	Traditional birth attendants ($n = 8$)
No. female	4	2	2	8
Reason for taking up role	Passion for helping women and children	Own HIV diagnosis; death of loved one due to HIV/AIDS; remote location	Chosen by community, previous work as community health workers	Assisted woman or self in childbirth; worked with facility-based workers
Mean no. years in role or similar (range)	3 (1–7)	3.5 (3–4)	10 (1–21)	16.3 (9–33)
Length of initial formal training	20 months	2 weeks	4 months	Not standard
Frequency of refresher trainings	At least annually	Annually	Annually	Very irregularly
Avg. no. patients/day (range)	26 (10–40)	3.8 (2–5)	11 (6–15)	^a
No. has another job	0	6	4	8

^aTraditional birth attendants were unable to quantify their average patient number on a daily, weekly, or monthly basis due to great variability

uptake of prenatal and postnatal healthcare. TBAs saw themselves in a unique position to broker resistance to health facility delivery by accompanying mothers.

Characterizing barriers and promoters experienced by health workers (objective 1)

Detailed results were organized according to the integrated ecological motivation-opportunity-ability framework, starting with the most proximal ecological level within each motivation, opportunity, and ability domain (Table 3). Key findings are summarized in the text below.

Motivation

Health worker: intrinsic motivation Nearly all participants were intrinsically motivated to make a difference in their patients' and communities' health (Table 3). HIV-infected *activistas* reported that modeling living healthfully with HIV helped them adhere to their own treatment regimens. CHWs were motivated by their ability to address health concerns in their own households. A few participants across cadres were motivated by continued learning opportunities. All cadres were demotivated by patients not following their recommendations, particularly when this resulted in poor health outcomes.

Health worker: extrinsic motivation All cadres overwhelmingly appreciated recognition from patients, the wider community, and other health workers and were distressed by patient complaints. While the majority of health workers described good inter-cadre relationships, community-based workers were more likely to express concern about how their work was viewed by facility-based workers. Visual identification of roles

(e.g., badges t-shirts, hats) was important to un-uniformed facility-based staff, *activistas*, and TBAs.

All cadres were dissatisfied with the current form, amount, or timeliness of compensation. Nearly all community-based workers held another job, predominantly subsistence farming, to support themselves. While one *activista* and one CHW noted they were happy to receive any monetary compensation for work they had previously performed uncompensated, TBAs were uncompensated for referring women for facility-based care but had previously been compensated for assisting in home deliveries (e.g., gifts from mothers, food staples from health facility). *Activistas* and TBAs reported that additional money would help to offset travel costs to and from patients' homes. However, one highly intrinsically motivated nurse did not believe an increase in remuneration would affect nurse performance:

I don't believe that increasing our salary would help improve the activities, because if I say this it means that I am accepting that we are holding back care for some women because we receive little [money]. Financial support could be used to help me as an individual, but it is not a way to improve the activities (Female nurse, 7 years of experience).

Opportunity

Patient: behaviors circumventing care For nurses, patients not presenting at the health facility, dropping out of care, and not adhering to treatment regimens challenged their ability to deliver PVT care. Patients who gave false addresses (to *activistas*) and called for assistance in already-underway home births (to TBAs) challenged community-based cadres.

Table 3 Barriers and promoters to delivering prevention of vertical transmission of HIV (PVT) services according to the ecological motivation-opportunity-ability (MOA) framework

Barrier (-), promoter (+)	Construct	Manifestation	Maternal and child health nurses, with other health facility workers from focus group discussions (FGDs)	Activistas	Community health workers (CHWs)	Traditional birth attendants (TBAs)
Motivation						
Health worker factors						
Intrinsic motivation						
+		Highly intrinsically motivated	"...when I help the community. It is what my heart wants" (F Nurse, 7 years)	"in the community there are no longer many people left living with HIV and without treatment...I feel happy that I attended to and helped [these] people" (M <i>activista</i> , 4 years)	"I help the people and my family as well. When health problems arise in my house I can resolve the problems more easily" (M CHW, 20 years)	"I never worked because I wanted money. I first worked because I wanted to help the community and then because I wanted to learn" (TBA, 12 years)
-		Dissatisfied when unable to help patients	"I do not like when difficult situations arise that I cannot solve...There was a case of a woman who had complications in birth. We tried to help but could not. The woman ended up dying" (F nurse, 3 years)	"A negative experience that struck me was a woman who refused to go to hospital and when her son died three weeks after birth" (F <i>activista</i> , 4 years)	"After some time, the person left [treatment] and the disease worsened...I counseled and the person agreed to go to the hospital...but lost [his/her] life" (F CHW, 21 year)	Women "refuse" to go to the health facility for delivery, placing TBAs in a compromised position (TBA, 17 years)
Extrinsic motivation						
+		Recognition from patients	"...when people appreciate my work. There was a case of a women that came up to me in [] and told me that I had saved her life. I did not even remember her" (F nurse, 3 years)	Good relationship with patients	"The people that I help always thank me and respect me" (M CHW, 2 years)	"The fact that I was chosen by the pregnant women to help already shows that the woman has trust in me. And I try to live up to this trust" (TBA, 9 years)
±		Recognition from community	"The people acknowledge us" (F nurse, 3 years)	"This patient insulted me, told me to leave, but I did not give up and ended up taking him to the hospital...he ended up dying. Today [at the funeral]...people said that I helped alot when the patient was sick" (M <i>activista</i> , 4 years)	"When the person died the family ... said I ...forced the person to go to the hospital, while the family wanted to take him to the healers" (F CHW, 21 year)	"I like to work because it gives me prestige in the community. I have recognition in my community. And people in my community trust me" (TBA, 33 years)
±		Recognition from other health worker cadres	-	Felt that their work linking patients to care was not valued by facility staff	Concerned that patient non-adherence reflects poorly on their work quality	"When a lot of time has passed between my presence at the health center, they miss me and ask where I have been" (TBA, 20 year)
±		Role identification	Data analyst and lay counselors did not have identification badges to signify their roles at health center (FGD participants)	Want T-shirts, hats, identification cards for work in the community	Had bright green vests	Not always recognized as a TBA when at health facility

Table 3 Barriers and promoters to delivering prevention of vertical transmission of HIV (PVT) services according to the ecological motivation-opportunity-ability (MOA) framework (Continued)

–	Patient complaints	“People always criticize our actions. The people say that they are not attended to well. It is complicated when you always receive criticism” (F nurse, 7 years)	Poor reception in homes (<i>activistas</i> insulted), patient complains <i>activista</i> has not visited often enough	Sick adults questioned why CHW cannot dispense medication to adults (e.g., for malaria)	–
–	Dissatisfaction with remuneration	Salary was low for amount of time spent (including late evenings, weekends); “Wages always arrive late” (F nurse, 3 years)	Subsidy spent on transportation to visit patients and attend meetings, to fix bicycles: “When the 850MT arrives, we have a lot of debt” (F <i>activista</i> , 3 years)	Subsidy had been delayed several months but was paid at time of interviews	“A little financial help would be really good, because we work but we do not receive anything” (TBA, 12 years)
Opportunity					
Patient factors					
–	Patient behavior circumventing care	“[Retaining women in PVT care] is a big war, because some agree to take the [HIV] test, follow the treatment during their pregnancy, but after the birth...the mother prefers to follow-up for the child and the mother abandons the treatment [for herself]” (F nurse, 7 years)	HIV-infected patient gave wrong address to reception so <i>activista</i> will not be seen at their house	–	“Many women say that they have yet to be full term and then have the baby at home” (TBA 443) TBAs feel obligated when called to assist woman in home delivery, even though they know it is against policy
Work mandate factors					
–	Referral systems	Mothers were referred to type III facilities for ART without follow-up	Patients returned to care remain on referral list given to <i>activistas</i> , who sometimes received two different referrals for same patient	–	No formal referral system; concerned about breaking confidentiality if refer a mother for ANC before mother is ready for pregnancy to be public
–	Record systems	Paper records for PVT (digital only for patients on ART); multiple nurses have to share one book (PO); problematic implementation of mothers’ PVT codes (FGD)	<i>Activista</i> leader compiled 20 <i>activista</i> members’ visits and services delivered by hand to generate reports	–	Newly implemented system: women reported facility delivery to her local TBA, who recorded information in a notebook and shared with community leader
Work environment					
±	Workload	“It is hard because we are few; when I am attending to a person and other people are complaining about the wait outside. We do the most we can, but it is a lot of things to do” (F nurse, 7 years)	Time spent was appropriate for volunteer position	Majority felt time spent was appropriate; however, sometimes patients came to their home which interrupted their household duties	–
–	Supplies	“We always have a lack of medicines” (F nurse, 3 years)	Lacked items for conducting home care (e.g., comb, bucket, soap, gloves)	Wanted gloves, scissors, medications for treating adults	Lacked materials to attend to “emergency” birth (e.g., gloves, mask, scissors, gown), flashlight for nighttime travel

Table 3 Barriers and promoters to delivering prevention of vertical transmission of HIV (PVT) services according to the ecological motivation-opportunity-ability (MOA) framework (Continued)

-	Infrastructure	Lack of privacy (e.g., child consultations conducted in open air hallways, lack of screens for women in maternity ward), lack of electricity and locks	Lack of office space (for meetings and storage) and equipment (e.g., desk, computer) for report writing	-	-
-	Distance	-	"What is difficult are the long distances that run between the houses and [being] without any means of transport" (M <i>activista</i> , 4 years); had bicycles but many now broken and no funds for upkeep	Distance manageable with bicycles but sandy paths were challenging	"It is a long distance to arrive at the health facility...the homes are far away from each other" (TBA 448)
Administrative environment					
PVT service planning and coordination					
+	Efforts to streamline care	Implementation of streamlined "one-stop" care and Option B+ (lifelong ART)	-	-	-
-	Processes create delays	Long waits for results for CD4 count (7 days), PCR (up to 6 months) due to analysis at regional and national hospitals; type II peripheral facility did not offer ART	-	-	-
-	Lack of incorporation into health system		Individual work linking patients to clinical care not recorded at health facility	-	"The women living with HIV, generally they go to the facility but when they...abandon care, I don't know [about it]" (TBA, 12 years). TBAs' interactions with health facilities and activities varied widely
Donors					
-	Financial practices differ from local standards	HIV-specific facility-based staff supported directly by PEPFAR (e.g., data analyst) did not receive raise when others did	-	-	N/A
Ability					
Health worker factors					
Health worker approach to patient interactions					
+	Sensitive to patients' opportunity challenges	"We sensitize [newly diagnosed HIV-infected woman] that if she does not have the courage to talk with her husband, we can help" (F nurse, 7 years)	Returned to counsel and care for patients even when verbally abused; encourage feeding complementary foods from farm	Report women experience food insecurity, cost of travel to health center	Discussing family planning: "They see the cost of living each day...if you have a lot of children everything is expensive and it isn't easy to sustain many children...the women don't manage to feed themselves regularly." (TBA, 7 years)
-	Language barrier	One nurse did not know local language at her first posting	-	-	-

Table 3 Barriers and promoters to delivering prevention of vertical transmission of HIV (PVT) services according to the ecological motivation-opportunity-ability (MOA) framework (Continued)

	Knowledge				
±	Infant and young child feeding (IYCF)	Correct, updated IYCF messages	Mix of correct and incorrect IYCF messages for HIV-infected women	Correct IYCF messages for HIV-uninfected women	Incorrect, outdated IYCF messages for HIV-infected and HIV-uninfected mothers
	Work environment				
±	Training	"It would be helpful for all colleagues to have the same capacity" (F nurse, 7 years); logistical challenges to training all nurses at once, potential for weariness	-	"There are cases of people who abandon [HIV] care, but I don't know how to talk to them because I was not trained in this material" (Female CHW 476)	"I didn't have any training. I worked as an assistant at a local health facility...I learned by observing the births that happened and I began to do them as well, in [nurses'] absence" (TBA, 7 years)
±	Supervision	Wanted more supervision to support skill building	Wanted more supervision and accompanying recognition	-	Did not report wanting more supervision
±	Collaboration with other cadres	"There are essential elements for good health in the community, we cannot leave anything out" (F nurse, 3 years). Nurses emphasized importance of TBAs to bring women for facility delivery	Sought to work directly with nurses and with neighbors who wield influence	Worked with TBAs, <i>activistas</i> , community leaders in person and via telephone "to harmonize messages" (Male CHW 479)	"It would be important to work with other actors, because that way I could learn from them and I can also teach what I know" (TBA 443)
±	Professional community	Interactions varied by facility leadership, facility-wide initiatives, and staff size	Met weekly for reporting; interacted in the field through supervisory visits or visiting patients in pairs	Met regularly or as-needed basis to coordinate activities, depending on community	Interacted at irregularly held trainings
-	Incorrect/inconsistent IYCF messages across health worker cadres who provide care for HIV-infected mothers				

Abbreviations used include *FGD* focus group discussion, *PO* participant observation, *N/A* not applicable, *ANC* antenatal care, *MCH* maternal and child health

Work mandate: poor referral systems Current referral systems were problematic for facility- and community-based cadres. Furthermore, lack of a communication system prevented community-based workers from calling ahead or obtaining transportation for an ill patient or a woman in labor.

Work mandate: cumbersome record systems PVT paper record systems were reported and observed to be cumbersome and, at times, inaccurate. Correct and consistent application of a unique PVT code for each HIV-infected mother and HIV-exposed child dyad was problematic and affected the ability to monitor and evaluate service delivery and patient dropout. Similarly, cumbersome reporting systems challenged *activista* associations' monitoring and evaluation,

Work environment: overburdened While *activistas*, CHWs, and TBAs generally felt their time commitments were appropriate, nurses frequently reported being overburdened. They served long lines of patients daily and then attended patients who presented for critical care after hours, interfering with nurses' own childcare.

Work environment: supplies All cadres reported lacking supplies or wanting additional ones to execute their responsibilities. Most problematic was medication stockouts for PVT. Community-based cadres lamented that they lacked materials to assist in home care (*activistas*), expansion of services to treat adults (CHWs), and kits for attending "emergency" births (TBAs).

Work environment: infrastructure All three health facilities were non-conducive to patient privacy (e.g., lack of screens), two lacked electricity, and one did not have locks or running water. Both *activista* associations lacked their own office space and equipment for report writing.

Work environment: distance Distance was a major challenge to *activistas* and TBAs who traveled to patients' homes and accompanied them to the health facility. For example, *activistas* were frustrated when they traveled long distances to find the patient was not home.

Administrative environment: PVT planning and program coordination Administrative-level challenges for nurses were tempered by the planned roll-out of new PVT programs, including the "one-stop" strategy to streamline PVT services in mid-2013 and Option B+ to initiate HIV-infected pregnant women on lifelong ART (at the district and large peripheral facility) in 2014. However, at the time of data collection, long waits for

CD4 count and PCR infant HIV test results and referral of ART-eligible patients to large facilities were significant challenges to service delivery and retaining women in PVT care. In the community, lack of systematic incorporation of *activistas* and TBAs into the health system resulted in missed opportunities to leverage their motivation and skills.

Administrative environment: donors Discrepancy existed in raises and allowances between positions paid directly by the Ministry of Health and by donors. For example, HIV-specific facility-based workers whose positions were funded through the PEPFAR-implementing partner reported not receiving a raise when other facility-based colleagues did.

Ability

Health worker: approach to patient interactions All cadres were sensitive to their patients' opportunity challenges. Nurses supported women in disclosing their HIV status to their partners and considered maternal finances when counseling on infant- and child-feeding options. Community-based workers were generally very sensitive to maternal poverty, food insecurity, and distance to the health facility.

Health worker: knowledge Although this study was not designed to evaluate knowledge, health workers discussed the infant and young child feeding messages that they counseled women on. All nurses and some community-based health workers relayed the updated guidelines Mozambique had adopted [33], but some *activistas* and TBAs reported outdated and incorrect messages for HIV-infected women. One TBA reported just learning that attending home births without protection was a potential route of HIV exposure.

Work environment: training Nurses, *activistas*, and CHWs received refresher trainings on an annual basis. For nurses, these trainings were provided by the Ministry of Health often at the provincial level. For the *activistas*, training was provided by CARE International, and for CHWs, by the Ministry of Health at the district or facility level. Some TBAs had attended trainings over the decades they had served their communities, which had been provided by different organizations, including CARE, in partnership with the Ministry of Health. All groups reported wanting more training.

Work environment: supervision Nurses, *activistas*, and CHWs welcomed additional supervision to help them learn and to provide on-the-job feedback. In addition,

activistas wanted supervision from the health facility to increase recognition, tying back to extrinsic motivation.

Work environment: professional community Nurse and CHW interactions within their respective cadres varied according to their health facility and community. *Activistas* met weekly, but TBAs reported interacting with other TBAs at irregularly held trainings.

Work environment: collaboration with other cadres All health workers were open to more collaboration to support mothers through the PVT cascade. Existing intra-cadre collaboration depended on the community leadership and cadre presence in the catchment area.

Assessing potential for PBIs to address barriers and build on promoters to delivery of PVT services (objective 2)

Proposed PBIs by cadre

Maternal and child health nurses and facility-based staff were interested in both personal incentives and reinvestment in service delivery. Suggested individual personal incentives included financial or material rewards such as paid work-related trips to the “best” performing health worker or group. Group incentives that built upon social recognition (e.g., T-shirts and transportation to represent the health facility at district-wide celebrations) were also of interest. Staff proposed reinvesting PBIs in collaborations (e.g., with TBAs, community leaders), social support mechanisms (groups for HIV-infected mothers, fathers of HIV-exposed children), and infrastructural improvements (e.g., increasing patient privacy, attract women to wait ahead of labor) to help retain HIV-infected women and their HIV-exposed children in the cascade of PVT services.

In addition to personal incentives and reinvestment in service delivery, *activistas* were interested in directing incentives to support the sustainability of their associations. *Activistas* proposed using PBIs to build an office for meeting and storage space and to start income-generating activities. Similar to health facilities, *activistas* sought to use incentives (e.g., lunch, transportation) to support knowledge sharing and coordination of care with other community-based actors. *Activistas* saw opportunities to reinvest incentives in service delivery by repairing bicycles, community engagement (e.g., plays, cooking demonstrations), and facilitating community health worker collaborations.

TBAs were primarily interested in PBIs as means of individual financial incentives, materials to support their work (e.g., flashlights, telephone credit, transportation), and collaboration with other community-based cadres.

Suggested metrics and concerns for distortions as a result of PBIs

Suggested metrics for awarding incentives at health facilities included evaluation of staff performance through records and patient ratings of the quality of the care interaction. There was interest in both individual and group metrics; however, tracking metrics at the individual health worker level would be difficult with the record systems and reporting practices that were in place. In addition, health facility participants felt that all facility-based workers contributed to clinical PVT care, but tracking PVT indicators would primarily reflect nurse and midwife efforts.

Activistas debated whether performance goals should be set at the individual or association level. While all cadres discussed effects on motivation, *activistas* were particularly concerned that awarding PBIs on an individual basis might demotivate their colleagues who did not receive the incentives. *Activistas* were concerned that incentives for particular indicators would detract from their other services.

In contrast to the facility-based workers and *activistas*, TBAs had no interest in setting group goals because they operated individually in their respective communities. TBAs also found individual goal setting problematic because of the variance in number of TBAs and pregnant women in their communities. Like *activistas*, TBAs were concerned with creating competition with their colleagues that would disrupt their collegial relationships.

Discussion

This theoretically driven evaluation of barriers and promoters of PVT service delivery revealed that health workers were highly motivated but encountered severe opportunity challenges. Facility-based staff were challenged across the ecological motivation-opportunity-ability domains by late payment and uncompensated after-hours work (motivation) and patients circumventing care, poor referral and record systems, heavy workloads, stock-outs, poor infrastructure, and administrative factors (opportunity). We found community-based cadres were dissatisfied with compensation (motivation), challenged by lack of supplies, distance, lack of incorporation into the health system (opportunity), and incorrect and outdated knowledge on infant- and young child feeding (ability).

Our findings reflect challenges encountered by facility-based workers in sub-Saharan Africa [34, 35]. We expand upon structural barriers of absenteeism and irregular supplies experienced by nurses in northern Mozambique [36]. We know that health workers' dissatisfaction with salary, poor record systems, work overload, and stock-outs can distort service values and feedback into motivation [37, 38]. In contrast, a supportive interpersonal environment (e.g., recognition, mentoring, training)

and adequate infrastructure (inclusive of workload, supplies, equipment) are key dimensions of facility-based worker satisfaction [39]. While our study found facility-based workers to be highly motivated, further investigation into workers' interpersonal environment and barriers' effects on service values is warranted, including identifying and reducing inefficiencies in workflow [40, 41].

One of the most striking challenges for community-based workers was the lack of integration into the health system, which threatens effective task shifting. Lack of integration and poor follow-up on their referrals prevents community-based providers' efforts from translating into health impact [42, 43]. In contrast, integrating motivated community-based health cadres can remedy ability and some opportunity barriers [44, 45]. This is particularly salient for TBAs whose knowledge and training varied drastically.

Our data suggest that PBIs would be appropriate for addressing the barriers that most cadres encounter across the ecological levels. PBIs are designed to target workers' ability to act on intrinsic motivation (by increasing supervision, support, empowerment) and external motivation (through financial and in-kind rewards) and are structured to address opportunity and ability challenges [46]. Facility- and community-based cadres reported that they would leverage PBIs for social recognition (worker level: motivation), patient engagement (patient level: opportunity), referral and record systems (work mandate level: opportunity), infrastructure (work environment: opportunity), and collaboration with other cadres and professional communities (work environment: ability) (Table 4). Indeed, successful PBIs have improved teamwork and record systems [47], enhanced transparency, and reduced corruption [47], all critical aspects of well-functioning health systems.

Our participants' concerns about the implementation of PBIs align with those in the literature. PBIs can introduce potential for neglect of non-incentivized tasks [48], gaming, and other distortions [49], and perceived unfairness of incentive distributions have led to poor implementation [50, 51]. For these reasons, and our novel finding that collective identity is important to workers in terms of choosing and monitoring incentives, careful creation of indicators and strong monitoring and evaluation systems are necessary to monitor distortions [49]. This focus aligns with implementation science and quality improvement approaches, which hold promise to reduce opportunity barriers across the continuum of PVT care [52] and are necessary to evaluate a well-functioning PBI [53].

We recognize that at the health system scale, incentives cannot overcome major structural barriers [46], including a dearth of qualified human resources with the dedicated time to implement and sustain quality management principles [54, 55]. However, PBIs have

Table 4 Potential for performance-based incentives (PBIs) to address barriers to health workers' delivery of prevention of vertical transmission of HIV services by ecological motivation-opportunity-ability factors

Construct	Potential for PBIs
Motivation	
Health worker factors	
Intrinsic motivation	Limited
Extrinsic motivation	Limited
Opportunity	
Patient factors	
Patients circumventing care	Very limited
Work mandate factors	
Referral system	Yes
Record system	Yes
Work environment	
Over-burdened	Limited
Supplies	Limited
Infrastructure	Limited
Distance	Very limited
Administrative environment	
PVT planning and program coordination	Yes
Foreign donors	Unclear
Ability	
Health worker factors	
Health worker approach to patient interactions	Limited
Work environment	
Training	Yes
Supervision	Yes
Collaboration with other cadres	Yes
Professional community	Yes

successfully improved quality of hospital management and supervision and support for peripheral facilities [56]. Furthermore, sustainability of PBI initiatives, particularly in donor-funded contexts, remains an understudied concern [57]. Thus, we find it appropriate for PBIs to be implemented alongside strong monitoring and evaluation programs to address some challenges faced by health workers delivering PVT services, and we recognize that PBIs cannot replace appropriate health system leadership, policy, and investment.

Strengths and limitations

We employed a strong qualitative design that led to iterative analysis among the four cadres that deliver PVT services, including often-overlooked TBAs. The

use of the ecological motivation-opportunity-ability framework addresses the dearth of multilevel theoretical frameworks that extend beyond an ecological approach to the advanced delivery of PVT care [6]. Finally, we engaged a variety of ground-level stakeholders to assess the context for a PBI intervention, again addressing identified gaps in the literature [58, 59]. A direct outcome of this approach was identifying that TBAs were not comfortable with goal setting, and thus, another approach (e.g., per-service PBI model [60]) may be more appropriate.

This study may not be generalizable to other regions of sub-Saharan Africa due to the history of Mozambique's health system. However, given similarities in motivation and opportunity challenges across sub-Saharan Africa, this work contributes important perspectives to the appropriateness of a touted method to PVT services. The cross-sectional nature of the interviews may have precluded the building of relationships necessary to discuss grave challenges, particularly with the CHWs and TBAs who were not heavily engaged in participant observation. Participant responses may have been influenced by social desirability bias [61] as well as answering in extremes, since participants knew this research would inform a pilot PBI study with potential for personal financial incentives. Participant TBAs were likely more linked with health facilities than TBAs who did not participate. However, we anticipate this underestimates TBAs' variance in health facility linkages, and thus, our report on engagement is conservative.

Finally, this paper evaluates the appropriateness of PBIs in addressing barriers that health workers, but not HIV-infected pregnant women and mothers, experience. We recognize that multifaceted and community-engaged solutions are necessary to eliminate the vertical transmission of HIV [62, 63]. However, improving the work environment of facility- and community-based health workers is meritorious in its own right, and improving the delivery of PVT services is one key facet of the solution.

Conclusions

We found that highly motivated health workers encountered severe opportunity challenges in their mandate to prevent vertical transmission of HIV. PBIs have the potential to address key barriers that facility- and community-based health workers face in delivering care to HIV-infected women and their HIV-exposed children, specifically by building upon existing intrinsic motivation and leveraging highly valued social recognition. Therefore, a controlled intervention monitoring the effects of PBIs on health worker motivation could lead to important insights about the feasibility of PBIs to improve the delivery of PVT services.

Additional file

Additional file 1: Semi-structured interview guide for four cadres of Mozambican health workers to characterize barriers and promoters to delivering prevention of vertical transmission of HIV services.

Abbreviations

CHW: Community health worker; PBI: Performance-based incentive; PVT: Prevention of vertical transmission of HIV; TBA: Traditional birth attendant

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Availability of data and materials

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

SLY and DP are the Principal Investigators of the overarching study from which the data were collected. RCS and SLY developed the interview guides with input from DP, OS, and RO. OS conducted the interviews. RCS developed the focus group guides with input from SLY, OS, and DP. OS and RCS facilitated the focus groups and conducted participant observation. RCS and JR conducted the qualitative analysis, with input from OS and SLY. RCS wrote the first draft with input from SLY. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable

Ethics approval and consent to participate

Ethical approval was granted by the Cornell University Institutional Review Board (Protocol ID# 1205003043), and letters of support were obtained from the district and provincial health authorities in Mozambique. Written or oral participant consent was obtained for all interviews depending on participant literacy. Group oral consent was obtained for focus groups.

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References

- Chi BH, Stringer JSA, Moodley D. Antiretroviral drug regimens to prevent mother-to-child transmission of HIV: a review of scientific, program, and policy advances for Sub-Saharan Africa. *Curr HIV/AIDS Rep.* 2013;10:124–33.
- World Health Organization. Consolidated guidelines on general HIV care and the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach. Geneva: World Health Organization; 2013. p. 269.
- UNAIDS. The gap report. Geneva: Joint United Nations Programme on HIV/AIDS; 2014. p. 1–422.
- Schechter J, Bakor AB, Kone A, Robinson J, Lue K, Senturia K. Exploring loss to follow-up among women living with HIV in prevention of mother to child transmission programmes in Côte d'Ivoire. *Glob Public Health.* 2014;9:1139–51.
- Turan JM, Nyblade L. HIV-related stigma as a barrier to achievement of global PMTCT and maternal health goals: a review of the evidence. *AIDS Behav.* 2013;17:2528–39.
- Schuster RC, McMahon DE, Young SL. A comprehensive review of the barriers and promoters health workers experience in delivering prevention of vertical transmission of HIV services in sub-Saharan Africa. *AIDS Care.* 2016;28:778–94.
- CNCS. Global AIDS response progress report: Mozambique. Maputo: Conselho Nacional de Combate ao HIV e SIDA and UNAIDS; 2014. p. 1–123.
- Ministry of Health of Mozambique. Mozambique demographic and health survey 2011. Calverton: National Institute of Statistics of Mozambique and ICF International; 2013. p. 1–430.
- UNAIDS. Mozambique: 2014 progress report on the global plan. Geneva: Joint United Nations Programme on HIV/AIDS; 2014. p. 1–4.
- Eichler R, Agarwal K, Askew I, Iriarte E. Performance-based incentives to improve health status of mothers and newborns: what does the evidence show? *J Health Popul Nutr.* 2013;11(Suppl 2):36–47.
- Ashir GM, Doctor HV, Afenyadu GY. Performance based financing and uptake of maternal and child health services in Yobe State, northern Nigeria. *Glob J Health Sci.* 2013;5:34–41.
- de Walque D, Gertler PJ, Bautista-Arredondo S, Kwan A, Vermeersch C, de Dieu BJ, et al. Using provider performance incentives to increase HIV testing and counseling services in Rwanda. *J Health Econ.* 2015;40:1–9.
- Basinga P, Gertler PJ, Binagwaho A, Soucat AL, Sturdy J, Vermeersch CM. Effect on maternal and child health services in Rwanda of payment to primary health-care providers for performance: an impact evaluation. *Lancet.* 2011;377:1421–8.
- Bonfrer I, Soeters R, Van de Poel E, Basenya O, Longin G, van de Looij F, et al. Introduction of performance-based financing in Burundi was associated with improvements in care and quality. *Health Aff.* 2014;33:2179–87.
- Binyaruka P, Patouillard E, Powell-Jackson T, Greco G, Maestad O, Borghi J. Effect of paying for performance on utilisation, quality, and user costs of health services in Tanzania: a controlled before and after study. *PLoS ONE.* 2015;10:e0135013.
- Connor C, Cumbi A, Borem P, Beith A, Eichler R, Charles J. Performance-based incentives in Mozambique: a situational analysis. Bethesda: Abt Associates; 2011. p. 1–77.
- Spisak C, Morgan L, Eichler R, Rosen J, Serumaga B, Wang A. Results-based financing in Mozambique's central medical store: a review after 1 year. *Global Health: Science and Practice.* Johns Hopkins University-Global Health, Bloomberg School of Public Health, Center for Communication Programs. 2016;4:1–13
- Touré H, Audibert M, Dabis F. To what extent could performance-based schemes help increase the effectiveness of prevention of mother-to-child transmission of HIV (PMTCT) programs in resource-limited settings? A summary of the published evidence. *BMC Public Health.* 2010;10:702.
- Rowe AK, de Savigny D, Lanata CF, Victora CG. How can we achieve and maintain high-quality performance of health workers in low-resource settings? *Lancet.* 2005;366:1026–35.
- Boudreau JW, Hopp W, McClain JO, Thomas LJ. On the interface between operations and human resources management. Ithaca: Cornell University, School of Industrial and Labor Relations, Center for Advanced Human Resource Studies; 2002. p. 1–41. Report No.: CAHRS Working Paper #02-22.
- Siemsen E, Roth A, Balasubramanian S. How motivation, opportunity, and ability drive knowledge sharing: the constraining-factor model. *J Oper Manag.* 2008;26:426–45.
- Audet CM, Burlison J, Moon TD, Sidat M, Vergara AE, Vermund SH. Sociocultural and epidemiological aspects of HIV/AIDS in Mozambique. *BMC Int Health Hum Rights.* 2010;10:15. BioMed Central Ltd.
- World Health Organization. World health statistics 2015. World Health Organization; 2015. p. 1–161.
- Kruk ME, Wladis A, Mbembati N, Ndao-Brumblay SK, Hsia RY, Galukande M, et al. Human resource and funding constraints for essential surgery in district hospitals in Africa: a retrospective cross-sectional survey. *PLoS Med.* 2010;7:e1000242
- Pfeiffer J, Montoya P, Baptista AJ, Karagianis M, Pugas Mde M, Micek M, et al. Integration of HIV/AIDS services into African primary health care: lessons learned for health system strengthening in Mozambique—a case study. *J Int AIDS Soc.* 2010;13:3.
- Ministry of Health. Plan for the year 2012: target group and district goal. Republic Mozambique. 2012;2012:1–5.
- CARE. Monitoring and evaluation of prevention of vertical transmission of HIV services in Inhambane, Mozambique. 2012.
- Ministry of Health. Programa de revitalização dos agentes polivalentes elementares. 2010. p. 1–37. Republic of Mozambique.
- Kallander K, Strachan D, Soremekun S, Hill Z, Lingam R, Tibenderana J, et al. Evaluating the effect of innovative motivation and supervision approaches on community health worker performance and retention in Uganda and Mozambique: study protocol for a randomised controlled trial. *Af J Reprod Health.* 2015;16:1–18.
- Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods.* 2006;18:59–82.
- Vaismoradi M, Turunen H, Bondas T. Content analysis and thematic analysis: implications for conducting a qualitative descriptive study. *Nurs Health Sci.* 2013;15:398–405.
- Bernard HR. Participant observation. *Social Research Methods.* Los Angeles: SAGE; 2012. pp. 309–43
- WHO. Guidelines on HIV and infant feeding 2010. Geneva: World Health Organization; 2010. p. 1–58.
- Sprague C, Chersich MF, Black V. Health system weaknesses constrain access to PMTCT and maternal HIV services in South Africa: a qualitative enquiry. *AIDS Res Ther.* 2011;8:10.
- Keugoung B, Ymele FF, Fotsing R, Macq J, Meli J, Criel B. A systematic review of missed opportunities for improving tuberculosis and HIV/AIDS control in sub-Saharan Africa: what is still missed by health experts? *Pan Afr Med J.* 2014;18:1–11.
- Geelhoed D, Lafort Y, Chissale E, Candrinho B, Degomme O. Integrated maternal and child health services in Mozambique: structural health system limitations overshadow its effect on follow-up of HIV-exposed infants. *BMC Health Serv Res.* 2013;13:207.
- Topp SM, Chipukuma JM, Hanefeld J. Understanding the dynamic interactions driving Zambian health centre performance: a case-based health systems analysis. *Health Policy Plan.* 2015;30:485–99.
- Franco LM, Bennett S, Kanfer R. Health sector reform and public sector health worker motivation: a conceptual framework. *Soc Sci Med.* 2002; 54:1255–66.
- Mbaruku GM, Larson E, Kimweri A, Kruk ME. What elements of the work environment are most responsible for health worker dissatisfaction in rural primary care clinics in Tanzania? *Human Resour Health.* 2014;12:1–9.
- Saronga HP, Duysburgh E, Massawe S, Dalaba MA, Savadogo G, Tonchev P, et al. Efficiency of antenatal care and childbirth services in selected primary health care facilities in rural Tanzania: a cross-sectional study. *BMC Health Serv Res.* 3rd ed. BioMed Central; 2014;14:96.
- de Jongh TE, Guro Urganji I, Allen E, Zhu NJ, Atun R. Integration of antenatal care services with health programmes in low- and middle-income countries: systematic review. *J Global Health.* 2016;6:1–15.
- Hamela G, Kabondo C, Tembo T, Zimba C, Kamanga E, Mofolo I, et al. Evaluating the benefits of incorporating traditional birth attendants in HIV prevention of mother to child transmission service delivery in Lilongwe. *Malawi Af J Reprod Health.* 2014;18:27–34.
- Audet CM, Salato J, Blevins M, Amsalem D, Vermund SH, Gaspar F. Educational intervention increased referrals to allopathic care by traditional

- healers in three high HIV-prevalence rural districts in Mozambique. Braitstein P, editor. *PLoS ONE*. 2013;8:e70326.
44. Byrne A, Morgan A. How the integration of traditional birth attendants with formal health systems can increase skilled birth attendance. *Int J Gynaecol Obstet*. 2011;115:127–34.
 45. Callaghan M, Ford N, Schneider H. A systematic review of task-shifting for HIV treatment and care in Africa. *Human Resour Health*. 2010;8:8.
 46. Morgan L, Eichler R. Performance-based incentives in Africa: experiences, challenges, lessons. Bethesda: Health Systems 2020, Abt Associates Inc; 2011. p. 1–77.
 47. Soeters R, Peerenboom PB, Mushagalusa P, Kimanuka C. Performance-based financing experiment improved health care in the Democratic Republic of Congo. *Health Aff*. 2011;30:1518–27.
 48. Kok MC, Dieleman M, Taegtmeyer M, Broerse JE, Kane SS, Ormel H, et al. Which intervention design factors influence performance of community health workers in low- and middle-income countries? A systematic review. *Health Policy Plan*. 2015;30:1207-27.
 49. Spisak C, Morgan L. Use of incentives in health supply chains: a review of results-based financing in Mozambique's central medical store. Arlington: USAID | Deliver Project; 2014. p. 1–54.
 50. Paul E, Sossouhounto N, Eclou DS. Local stakeholders' perceptions about the introduction of performance-based financing in Benin: a case study in two health districts. *Int J Health Policy Manag*. 2014;3:207–14.
 51. Chimhutu V, Lindkvist I, Lange S. When incentives work too well: locally implemented pay for performance (P4P) and adverse sanctions towards home birth in Tanzania—a qualitative study. *BMC Health Serv Res*. 2014;14:1.
 52. Sturke R, Harmston C, Simonds RJ, Mofenson LM, Siberry GK, Watts H, et al. A multi-disciplinary approach to implementation science: the NIH-PEPFAR PMTCT Implementation Science Alliance. *J Acquir Immune Defic Syndr*. 2014;67:S163–7.
 53. Ssengooba F, McPake B, Palmer N. Why performance-based contracting failed in Uganda—an “open-box” evaluation of a complex health system intervention. *Soc Sci Med*. 2012;75:377–83.
 54. Mbindyo P, Gilson L, Blaauw D, English M. Contextual influences on health worker motivation in district hospitals in Kenya. *Implementation Sci*. 2009;4:43.
 55. Cailhol J, Craveiro I, Madede T, Makoa E, Mathole T, Parsons AN, et al. Analysis of human resources for health strategies and policies in 5 countries in Sub-Saharan Africa, in response to GFATM and PEPFAR-funded HIV-activities. *Global Health*. 2013;9:52.
 56. Janssen W, de Dieu NJ, Matungwa M, Van Bastelaere S. Improving quality through performance-based financing in district hospitals in Rwanda between 2006 and 2010: a 5-year experience. *Trop Doct*. 2015;45:27–35.
 57. Witter S, Fretheim A, Kessy F, Lindahl A. Paying for performance to improve the delivery of health interventions in low-and middle-income countries (review). *The Cochrane Database of Systematic Reviews*. 2012;:1–83.
 58. Witter S, Toonen J, Meessen B, Kagubare J, Fritsche G, Vaughan K. Performance-based financing as a health system reform: mapping the key dimensions for monitoring and evaluation. *BMC Health Serv Res*. 2013;13:367.
 59. Magrath P, Nichter M. Paying for performance and the social relations of health care provision: an anthropological perspective. *Soc Sci Med*. 2012;75: 1778–85.
 60. Satti H, Motsamai S, Chetane P, Marumo L, Barry DJ, Riley J, et al. Comprehensive approach to improving maternal health and achieving MDG 5: report from the mountains of Lesotho. *PLoS ONE*. 2012;7:e42700.
 61. Bonenberger M, Aikins M, Akweongo P, Wyss K. The effects of health worker motivation and job satisfaction on turnover intention in Ghana: a cross-sectional study. *Human Resour Health*. 2014;12:43.
 62. Rogers AJ, Weke E, Kwena Z, Bukusi EA, Oyaró P, Cohen CR, et al. Implementation of repeat HIV testing during pregnancy in Kenya: a qualitative study. *BMC Pregnancy Childbirth*. 2016;16:1–11.
 63. Marcos Y, Phelps BR, Bachman G. Community strategies that improve care and retention along the prevention of mother-to-child transmission of HIV cascade: a review. *J Int AIDS Soc*. 2012;15:1–10.

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