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## **A comprehensive review of the barriers and promoters health workers experience in delivering prevention of vertical transmission of HIV services in sub-Saharan Africa**

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### **Abstract**

Despite significant biomedical and policy advances, 199,000 infants and young children in sub-Saharan Africa became infected with HIV in 2013, indicating challenges to implementation of these advances. To understand the nature of these challenges, we sought to (1) characterize the barriers and facilitators that health workers encountered delivering prevention of vertical transmission (PVT) services in sub-Saharan Africa and (2) evaluate the use of theory to guide PVT service delivery. The PubMed and CINAHL databases were searched using keywords barriers, facilitators, HIV, prevention of vertical transmission of HIV, health workers, and their synonyms to identify relevant studies. Barriers and facilitators were coded at ecological levels according to the Determinants of Performance framework. Factors in this framework were then classified as affecting motivation, opportunity, or ability, per the Motivation-Opportunity-Ability framework (MOA) in order to evaluate domains of health worker performance within each ecological level. We found that the most frequently reported challenges occurred within the health facility level and spanned all three MOA domains. Barriers reported in 30% or more of studies from most proximal to distal included those affecting health worker motivation (stress, burnout, depression), patient opportunity (stigma), work opportunity (poor referral systems), health facility opportunity (overburdened workload, lack of supplies), and health facility ability (inadequate PVT training, inconsistent breastfeeding messages). Facilitators were reported in lower frequencies than barriers and tended to be resolutions to challenges (e.g. quality supervision, consistent supplies) or responses to an intervention (e.g. record systems and infrastructure improvements). The majority of studies did not use theory to guide study design or implementation. Interventions addressing health workers' multiple ecological levels of interactions, particularly the health facility, hold

promise for far-reaching impact as distal factors influence more proximal factors. Incorporating theory that considers factors beyond the health worker will strengthen endeavors to mitigate barriers to PVT service delivery.

## Keywords

prevention of vertical transmission of HIV; health workers; health systems; performance; theory

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## Introduction

Nearly 35 million people are infected with HIV/AIDS globally, of which 71% live in sub-Saharan Africa (SSA) (UNAIDS, 2014). There, the collective routes of vertical transmission of HIV in utero, during delivery, or during breastfeeding remain a prevalent mode of HIV transmission (UNAIDS, 2014). Biomedical and policy advances have reduced vertical transmission rates to as low as 1–2% in efficacy studies and under 5% in “real-world” conditions (Chasela et al., 2010; Chi, Stringer, & Moodley, 2013; WHO, 2013). Despite these advances, 199,000 infants and young children in SSA were infected with HIV via vertical transmission in 2013 (UNAIDS, 2014). If the biomedical and policy innovations to prevent vertical transmission of HIV (PVT) were appropriately implemented, incidence would be lower.

There are significant barriers to PVT on both the provider and beneficiary sides. Three recent reviews have revealed that significant barriers to women’s uptake of PVT services span their many “ecological” levels of interactions (Gourlay, Birdthistle, Mburu, Iorpenda, & Wringe, 2013; hLarlaithe, Grede, de Pee, & Bloem, 2014; Tuthill, McGrath, & Young, 2013). However, less attention has been paid to the barriers and facilitators that health workers encounter in delivering PVT services. Yet health workers have been at the center of one of the major solutions to rapidly scale-up PVT services: “task shifting,” or the transfer of specific tasks to less specialized health workers (World Health Organization, 2008). In addition to increasing health system capacity, including the number of community health workers (CHWs), task shifting has created challenges in the health system including how to ensure adequate training, supervision, remuneration, and recognition (Callaghan, Ford, & Schneider, 2010; Mwai et al., 2013). Strikingly, systematic investigation of health workers’ experiences delivering PVT care is lacking.

Furthermore, the use of theoretical frameworks in PVT service delivery has yet to be assessed despite the continued development of health worker-focused theory. Health worker performance literature has progressed from its basis in individual motivational and cognitive theories (Locke & Latham, 2002; Ryan & Deci, 2000) to interpersonal and organizational constructs (Dickin, Dollahite, & Habicht, 2011; Okello & Gilson, 2015). Multi-level frameworks characterizing the complex factors necessary to target facility- and community-based health worker motivation and performance in low- and middle-income countries are increasingly common (Franco, Bennett, & Kanfer, 2002; Kok et al., 2014; Naimoli, Frymus, Wuliji, Franco, & Newsome, 2014). However, the degree to which these frameworks are engaged in the research on PVT service delivery is unclear.

Therefore, the objectives of this literature review were (1) to characterize the barriers and facilitators that health workers encounter in delivering PVT services in SSA and (2) to evaluate the use of theory to guide the design, implementation, and analysis of studies under review.

## Methods

### Search strategy

The keywords barriers, facilitators, HIV, prevention of vertical transmission of HIV, types of health workers, and their synonyms were searched in the PubMed and CINAHL databases (Supplemental Table 1). The search was limited to studies conducted in SSA and published in English before November 12, 2014. References were imported into Refworks to resolve duplicates and evaluate titles and abstracts.

We initially identified 192 references and reduced this to 26 through the review process (Figure 1). Bibliographic features on Web of Science were used to identify additional articles which cited those 26 references. These articles were then reviewed for relevance, yielding an additional 22 articles.

### Data extraction and organization

Two co-authors independently extracted study characteristics, overall study findings, barriers, and facilitators. Differences were resolved through discussion. In cases of unclear study characteristics, the corresponding author was contacted up to two times and the senior author once via email for clarification.

Studies were subdivided by those conducted prior to 2007 and 2007 and later, when the 2006 World Health Organization recommendations for mother-infant dyad treatment and prophylaxis (WHO, 2006) and IYCF practices (WHO, 2007) began to be implemented.

**Synthesis of results**—Two complimentary frameworks were integrated to guide this synthesis (Figure 2). The first was the Determinants of Performance research agenda which is embedded within an ecological framework (Rowe, de Savigny, Lanata, & Victora, 2005). The second is the Motivation-Opportunity-Ability framework (MOA), which posits that each of its three domains is necessary for optimal worker performance (Boudreau, Hopp, McClain, & Thomas, 2002; Siemsen, Roth, & Balasubramanian, 2008).

Determinants of Performance was used as the organizing framework because it places the health worker at the center and moves outwards for a total of six ecological “levels”. The health worker level focuses on individual factors (e.g. motivation, knowledge, skills). The patient level includes characteristics pertinent at point of care (e.g. patients’ severity of illness, demands for inappropriate treatments). The work level encompasses factors directly related to the worker’s mandate (e.g. complexity of clinical guidelines), while the health facility environment includes determinants of work environment such as caseload, availability of supplies, and supervision. The administrative environment consists of health system aspects beyond the health facility (e.g. support for supervisors, decentralization).

Finally the political and economic environment specifies the educational infrastructure, which we modified to include health worker retention and political commitment.

The MOA was applied to describe health worker performance within each ecological level (Blumberg & Pringle, 1982). Motivation is the health worker's desire and willingness to act and thus predominantly fits within the health worker level. Ability is the capability to execute the action, and its domain overlaps with health worker and some health facility factors. Finally, the opportunity domain consists of the contextual factors that facilitate the action, and thus encompasses all levels beyond the individual.

Barriers and facilitators to delivery of PVT care were coded and organized according to the Determinants of Performance framework, to which iterative modifications were made in response to the presence of specific factors. Articles were then reviewed a second time with the modified framework to identify initially overlooked cases. Following this, factors were classified by MOA domains and ordered by percent of studies reporting that factor. A cutoff of 30% was used to describe "frequently reported" barriers or facilitators. We selected this rather low cutoff as appropriate to convey those barriers and facilitators that were most prominent, as not all studies evaluated all barriers and facilitators. (Actual frequencies can be seen in Tables 2 and 3.)

## Results

### Study characteristics

Of the 47 eligible studies, 20 were conducted prior to 2007 and 27 were conducted in 2007 and later (Table 1). Studies took place in 16 different countries, with South Africa (n=16) the most frequently represented country and southern (n=31) and eastern (n=15) Africa the most represented regions. Studies were most frequently conducted in both urban and rural settings (n=20), followed by solely rural (n=14), urban (n=12), and unclear (n=1) settings. The majority of studies were conducted within the public health system (n=26), followed by both public and private (n=8), community-based (n=3), private only (n=2), and unclear (n=8). Eight studies included community-based health workers such as CHWs or traditional birth attendants (TBAs).

### Use of theory

The vast majority of authors did not substantively report using non-methodological theory to guide the design, implementation, or analysis of their study. Exceptions included the expanded health systems approach [Study #24, Table 1], a self-developed framework [#36], and Foucault's theory of governmentality [#45]. Nine of the 36 studies that collected qualitative data reported using analytic theories to guide qualitative analysis [#7,9,10,14,15,37,40,44,45].

### Barriers to delivery of PVT services

**Motivation**—At the health worker level, intrinsic motivation was frequently challenged by stress, burnout, and depression [#1,4,5,8–12,14,21,30,34,35,37,39,40,45,47], as well as the emotional burden that accompanied caring for patients living with HIV

[#1,4,8,10,14,15,21,34,37,40,45,47] (Table 2). For example, health workers interviewed in Uganda reported high stress from repeatedly counseling young pregnant women following an HIV-positive diagnoses [#14]. Barriers to extrinsic sources of motivation (e.g. dissatisfaction with remuneration [#5,9,10,21,22,34,44], late payment [#40], lack of recognition [#9,12,33]) were reported in comparatively lower frequencies. At the administrative level, four of the 15 studies including lay and community-based workers found these cadres were not formally recognized [#12,16,33,44].

**Opportunity**—Health workers feeling chronically overburdened was the most frequently reported challenge overall and occurred at the health facility level [#1,4–7,9–11,14,15,19,20–23,25,26,29–31,34–40,42,43,45–47]. For example, providing PVT services within antenatal care (ANC) increased workload, often without a commensurate increase in staffing [#34], resulting in counselors feeling rushed by long lines and inability to take breaks [#14]. In early roll-out of PVT services, counseling was often provided by nurses moonlighting as counselors, contributing to their overburdened feeling [#4,10]. Other frequently reported health facility challenges included lack of supplies (e.g. PVT-specific medicines [#7,11,16,20,24–26,32,33,36,40], rapid HIV tests [#6,9,26,31,35,36,40,42]), and private spaces for PVT counseling and delivery [#5–7,9,14,15,24,25,31,32,35,37,38,47].

Challenges at the patient and work levels emerged as more problematic in studies conducted in 2007 onwards. Patients reportedly hid their HIV-infected status, e.g. removing identifying stickers from their health card [#6]. Other behaviors at point of care attributed in part to stigma included women's refusal of HIV testing [#14,15,26], skipping counseling sessions [#1,12], and delivering with a TBA [#16,27,33,43,44], although these overlap with sociocultural factors. Poor referral systems resulting in patients lost to follow-up [#1,4,10,11,14,15,20,23,27–31,35–38,40,41,43,44,46], cumbersome record systems [#21,24,26,27,35,36,40], and confusion around clinical IYCF guidelines [#1,17,20,23,24,35,36,38,39,46] were work level factors reported more frequently in studies conducted 2007 onwards.

Administrative challenges were reported slightly more frequently in studies conducted 2007 onwards but less frequently than other ecological levels overall. The most frequently reported barriers were the fragmentation of PVT services [#1,8,10,11,13,21,23,37,38,40,41,43,46], implications of which include the “de facto segregation” of HIV-infected women that could potentiate stigma [#21], missed opportunities for delivery of PVT services [#40] including IYCF counseling [#23] and family planning and condom usage [#36]. Lack of government funding [#11,14,15,33,37,39,43], poor planning for launch or scale-up of PVT services [#5,10,32,37,38,43], and discordant foreign donor agendas [#7,37,39,44] were reported in lower frequencies and without obvious time trends.

Ambiguity around work roles appeared to be unique to lay and community-based health workers in this review. For example, these cadres reported not feeling respected by clinical health workers [#12,44], and less than one-third of lay health workers had received a written job description in one study [#9]. TBAs were considered an asset to PVT when providing referrals [#20,33,36] but a barrier when conducting unsanctioned home births [#16,27].

TBAs were found to be effective when training, supervision, and referral systems were in place [#20,27].

**Ability**—Ability challenges occurred at the health worker and health facility levels and tended to be less frequently reported in studies conducted in 2007 and later. The most frequently reported challenges occurred at the health facility and were PVT training identified as inadequate due to its incompatibility with training needs or irregular delivery [#3–5,7–10,12,14–18,21–25,29,32,33,35–37,43,44,47] followed by delivery of inconsistent IYCF messages [#1,2,4,6,7,9,10,14,15,17,18,20,21,23,25,28,35–37,40]. Poor supervision [#5,8,9,12,22,24,30,35–38,43,44], including lack of feedback on performance, was a health facility barrier that was reported slightly more frequently among later studies.

At the health worker level, low knowledge of HIV transmission paths [#2–4,9,14,17,18,36] and poor self-efficacy in diagnosing or counseling patients on HIV [#3,8,9,14] decreased in reported frequency in studies conducted 2007 and after.

### Facilitators to delivery of PVT services

Facilitators were reported in lower frequencies than barriers and tended to be resolutions (Table 3). Health workers were frequently intrinsically motivated by effecting behavior change and saving lives [#1,4,7–9,12,15,25,45] and less frequently motivated by salary [#30,38], others valuing their work [#21], or professional opportunities [#30].

Facilitators to health workers' ability to provide care included confidence regarding HIV transmission knowledge (health worker level [#34,36,37]) and appropriate training (health facility level [#5,13,15,22,38,45]). Opportunity facilitators at the work level included improvements to record systems [#5,8,24,26], and those at the health facility included consistent supplies [#13,24,36,45] and facility updates [#13,15,26] as well as quality supervision [#5,13,26,30]. Integration of PVT services [#15,23,38] and NGO's technical [#2,15,21,23,44] and financial support [#14,21,45] were facilitators at the administrative level.

Lay and community-based health worker cadres were found to contribute to improved quality and quantity of PVT services [#6,8,9,21,33,38,44]. For example, lay health workers contributed to decreased drop-off of women in the beginning of the PVT cascade [#6], workload for skilled health workers, and HIV stigmatization in the community [#9]. CHWs facilitated PVT through conducting community HIV education [#6,8], leading support groups for HIV-infected women [#8,21,23], and recovering patients considered lost to follow-up [#21].

### Discussion

This theoretically-driven synthesis of 47 studies evaluating PVT service delivery has made it clear that focusing predominantly on the individual-level factors of motivation, knowledge, and self-efficacy, while necessary, is not sufficient to improve delivery of PVT services. The more frequent reporting of barriers and facilitators to intrinsic motivation compared to extrinsic suggests the relative importance of intrinsic motivation to health workers in low-



resource settings. Challenges to knowledge and self-efficacy were generally reported less frequently in 2007 and later, potentially reflecting the increased experience of workers in delivering PVT services, effectiveness of early ability-focused interventions, or changes in study objectives over time. Conversely, challenges in the patient, work, and administrative levels were reported slightly more frequently in studies conducted 2007 onwards.

Systematic inquiry is grounded in robust theory, which leads to advancement of knowledge and practice (Friedman, 2003). The absence of theoretical guidance in the majority of studies under review suggests a gap in the regular application of recognized theoretical perspectives in studies focusing on health workers in context of PVT.

The novel integration of the MOA with the Determinants of Performance framework identified the domains affecting performance within each ecological level of a health worker's delivery of PVT services. The most frequently reported challenges coalesced in the health facility and spanned all three MOA domains. Seven barriers were reported in over 30% of studies; one each at the health worker (motivation), patient (opportunity), and work level (opportunity), and four at the health facility (two opportunity, two ability).

The majority of challenges occurred within the opportunity domain. Although addressing these numerous and complex contextual challenges is difficult in the face of severe resource constraints, this strategy has potential to mitigate challenges in other domains. For example, motivation is a complex construct influenced by health workers' own abilities as well as organizational, patient, community, and cultural contexts (Franco et al., 2002). Thus, an approach that incorporates the facility, administrative, and political-economic environments will impact motivation and ability as well.

Implementation science is one such approach that holds promise to close the gaps that result in infant and young child HIV infection. Implementation science systematically incorporates contextual factors across ecological levels into study design and evaluation (Sturke et al., 2014). This has already provided insights into the need for increased focus on administrative factors of leadership, management, and funding (Edwards & Barker, 2014), and interventions using iterative, systems-view approaches have potential to reduce patient drop-off along the PVT cascade (Sherr et al., 2014). Thus, we suggest incorporating implementation science principles into research on delivery of PVT services to more effectively identify and address opportunity challenges.

This review characterized serious bi-directional challenges at the point of care that are influenced by sociocultural trends. Respectful consideration of patients' needs was lacking in one-fifth of studies [#1,8,10,16,21,27,31,40,47]. Documented in maternal healthcare generally (Silal, Penn-Kekana, Harris, Birch, & McIntyre, 2012), this is even more problematic considering the stigma, gender, and socioeconomic vulnerabilities associated with HIV (Ramjee & Daniels, 2013). Furthermore, two studies reported maternal compliance within the PVT cascade was portrayed as a means for preservation of her child's health [#1,45], contrary to the known benefits of treating a woman for her own sake (Marazzi et al., 2011; UNAIDS, 2014).

These factors may influence patients' hiding of noncompliant behaviors, which could circumvent women's opportunity to receive appropriate care. For example, fear and psychological distress following an HIV-positive diagnosis influenced women's refusal of HIV testing [#10,14,15,41,46] and the hiding of HIV-infected status later in care [#1,27,33–36,38,43–45,47]. Stigma alone has been shown to impact women's drop-off at every step of the PVT cascade (Turan & Nyblade, 2013). Thus, we propose that practices to mitigate stigma and respectfully approach women should be incorporated into PVT delivery interventions.

Engaging community-based health workers in delivery of PVT was one such strategy found to be effective in this review. Early community health worker engagement increases enrollment of HIV-exposed and -infected infants and young children in care (Ahmed et al., 2015) and positively influences exclusive breastfeeding and child growth (Tomlinson et al., 2014). However, this review found lay and community-based health workers' to have unclear status and roles, which can lead to health workers performing tasks outside their training or not living up to expectations. Thus, clear job descriptions, supportive supervisory structures, and formal recognition in the health system are necessary in order to capitalize on these benefits of community-based and lay health workers.

### Lessons learned

This comprehensive literature review used two popular databases and generated a strong number of studies for inclusion. While this review has captured published reports likely reflective of non-peer-reviewed material, there is potential for missed information in organizational reports and documents.

The Determinants of Performance framework was proposed as a research agenda for interventions. Thus, it includes most but perhaps not all potential ecological levels (e.g. sociocultural factors).

Differences in study objectives and methodologies across our 47 articles may have limited the factors reported. For example, the low reported frequency of administrative and political-economic factors may be reflective, in part, of study objectives focusing on more proximal factors. However, this does not mean those factors were not salient, rather perhaps they were not probed (Gourlay et al., 2013). Similar caution should be applied to interpretation of our findings across time groupings.

Finally, community-based health workers were under-represented in our review, which was surprising given their widespread involvement in the PVT cascade. This may reflect their more recent integration into health systems or a gap in research about their experiences. With current global focus on their potential, continued evaluation of community-based health workers is necessary.

### Conclusions

To eliminate vertical transmission of HIV, interventions need to address the multiple ecological levels and contextual factors involved in delivery of PVT services. Individual



health worker level barriers may be decreasing. Thus, a focus shift to factors at the health facility and administrative environments holds promise for far-reaching impact, as does meaningful integration of community-based health workers into the health system. Both facility- and community-based health workers have a role to play in respectfully engaging and retaining women in PVT care and reducing surrounding stigma. Incorporation of implementation science principles into research on delivery of PVT services can illuminate structural opportunity challenges and pathways through which to address them. Research seeking to strengthen the delivery of PVT services should incorporate theory to address factors beyond the individual's motivation and ability when assessing health workers' barriers and facilitators.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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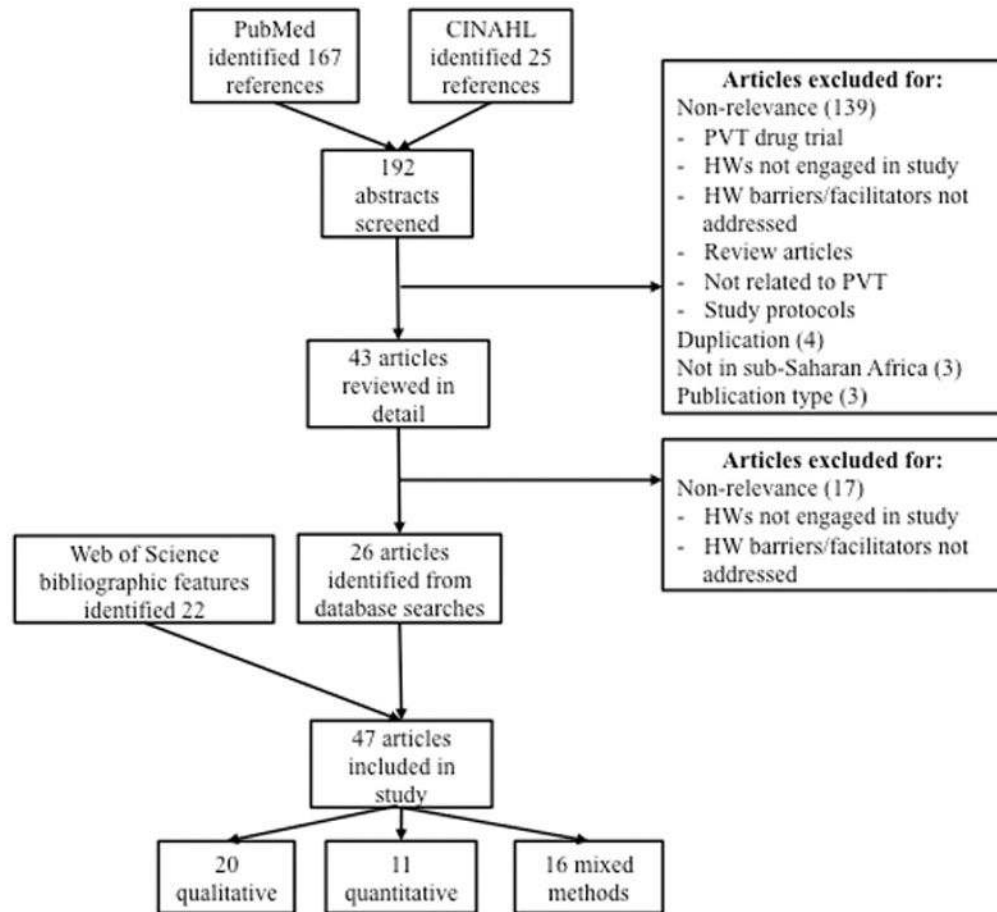
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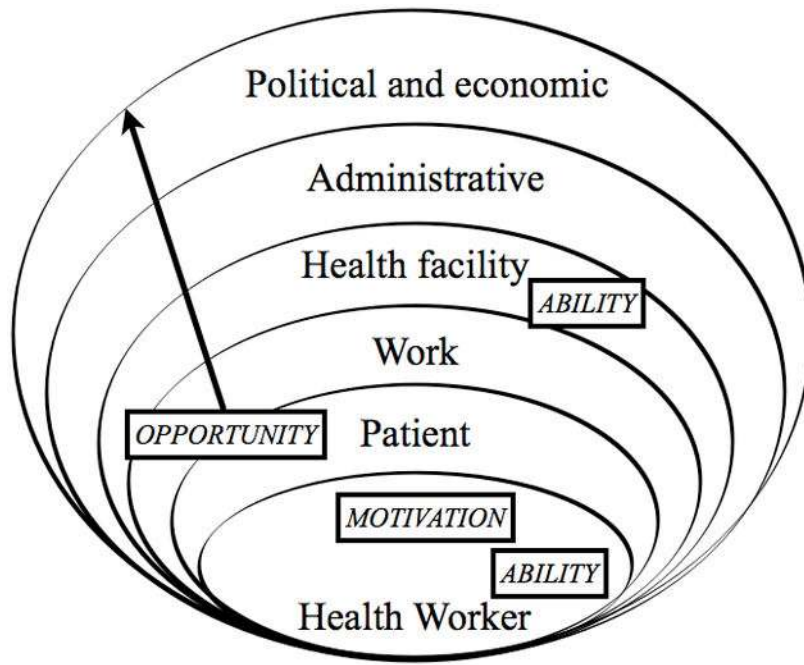
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**Fig. 1.** Literature search strategy for barriers and facilitators to health workers' delivery of prevention of vertical transmission of HIV (PVT) services



**Fig. 2.** Integration of the Determinants of Performance and the Motivation-Opportunity-Ability frameworks

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Table 1

Key characteristics of studies included in review of barriers and promoters to delivery of prevention of vertical transmission of HIV (PVT) services in sub-Saharan Africa (n=47)

No.	Author(s), Year	Year conducted	Country	Setting <sup>d</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
1	Buskens and Jaffe, 2008	2003	Namibia, South Africa, Swaziland	Urban and rural: 11 health centers and hospitals <sup>a</sup>	FGDs, IDIs, participant observation	5 PVT physicians or coordinators, 10 nurses, 7 counsellors, 167 mothers, 11 pregnant women, 32 relatives	To explore the perceptions and experiences of mothers and providers on infant feeding counseling in the context of PVT	None
2	Chopra and Rollins, 2008	2003	Botswana, Kenya, Malawi, Uganda	Urban and rural: 29 health centers	FGDs, participant observation, surveys	334 HWs, 640 patients in counselling observations, men and women (in 34 FGDs)	To assess provider knowledge and quality of infant feeding counseling of PVT programs	None
3	Creek et al., 2007	2003	Botswana	Urban and rural: 12 clinics, 1 maternity hospital <sup>d</sup>	Surveys	66 midwives, 16 counsellors, 504 pregnant/postpartum women	To characterize the factors influencing women to accept or refuse an HIV test; to describe what constitutes adequate PVT knowledge for HWs	None
4	de Paoli et al., 2002	2000–2001	Tanzania	Urban: 1 private hospital	IDIs	2 doctors, 16 nurses, 5 counsellors	To evaluate the quality and perceived influence of infant feeding counseling on HIV-infected pregnant women	None
5	Delva, 2006	2003	South Africa	Urban: 1 public hospital	SSIs	3 program coordinators, 3 doctors, 1 pharmacist, 7 midwives	To explore the challenges and potential solutions for use of single-dose Noverapine for PVT	None
6	Doherty et al., 2005	2002	South Africa	Urban and rural: 18 PVT sites <sup>d</sup>	Records review, SSIs	HWs (unspecified)	To evaluate the uptake and performance of South Africa's national pilot PVT program	None

*Studies conducted prior to 2007 (n=20)*

No.	Author(s), Year	Year conducted	Country	Setting <sup>d</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
7	Fadnes et al., 2010	2003–2005	Uganda	Rural: public hospitals, health centers, and NGO projects <sup>d</sup>	FGDs, IDIs, surveys	18 clinical officers, nurses and midwives, HIV-exposed women (in 7 FGDs), community members (in 8 FGDs), 727 HIV-uninfected and 235 HIV-infected mothers	To assess delivery of infant feeding counselling: to evaluate the experiences of providers and mothers delivering and receiving this counseling	None
8	Horwood et al., 2010(B)	2006	South Africa	Urban and rural: public health centers <sup>d</sup>	FGDs	Nurses, mothers and family members	To characterize attitudes and experiences of nurses and mothers during HIV testing in the integrated management of childhood illness	None
9	Ledikwe et al., 2013	2002–2010	Botswana	Urban, peri-urban, and rural: public health centers <sup>d</sup>	Counselling observations, client exit interviews, FGDs, IDIs	17 policymakers, 23 district coordinators, 39 HWs (physicians, nurses, midwives, social workers), 400+ lay counsellors, 47 patients	To evaluate the effectiveness and contributions of lay HIV counsellors	None
10	Leshabari et al., 2007	2003–2004	Tanzania	Urban: 2 public hospitals and 2 public health centers	FGDs, IDIs	25 nurses	To explore concerns and experiences of nurses providing infant feeding counselling in the context of PVT	None
11	Levy, 2009	2004–2005	Malawi	Rural: 1 public clinic	FGDs, longitudinal IDIs, participant observation	21 health personnel (PVT policymakers, aid organizations, medical staff, nurses), 55 HIV-infected women	To characterize women's expectations and experiences of HIV treatment and care	None
12	Malema et al., 2010	2006	South Africa	Urban: 15 public health centers	SSIs	15 lay counsellors	To characterize the experience of lay counsellors who provide HIV counseling and testing	None
13	Mazia et al., 2009	2006–2007	Swaziland	Urban and rural: 3 public and private hospitals and 4 public MCH units	Postnatal care training intervention; HW interviews, patient exit interviews, patient observations, health center assessment	134 HWs (mostly nurses) trained, 700 patients (HIV-infected and -uninfected)	To evaluate the feasibility of integration of postnatal care with PVT care following intervention (training)	None

No.	Author(s), Year	Year conducted	Country	Setting <sup>a</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
14	Medley et al., 2010	2005	Uganda	Urban and rural: 10 public and private clinics <sup>a</sup>	SSIs	3 center managers, 27 counsellors	To characterize the challenges of provider-initiated testing and counselling	None
15	Nuwagaba-Biribonwoha et al., 2007	2003	Uganda	Rural: 5 public and private hospitals	IDIs	5 PVT coordinators, 5 doctors, 5 counsellors	To characterize the experiences of key HWs in early implementation of PVT services	None
16	Perez et al., 2008	2006	Zimbabwe	Rural: community-based	FGDs, surveys	72 TBAs (FGDs), 627 women (surveys)	To evaluate the acceptability and feasibility of TBAs' inclusion in MCH through participation in PVT	None
17	Piwoz et al., 2006	2002	Malawi	Urban and rural: health centers <sup>a</sup>	SSIs	5 clinical officers and medical assistant, 14 nurses and midwives	To characterize health workers' attitudes and infant feeding counselling messages in the context of PVT	None
18	Shah et al., 2005	2000	South Africa	Rural: 1 public hospital and 14 public health centers	SSIs, surveys	14 doctors, 41 nurses, 16 CHWs	To assess HW breastfeeding and PVT knowledge	None
19	Simba et al., 2008	2005	Tanzania	Urban and rural: 60 predominantly public health centers <sup>a</sup>	Participant observation, records review	435 service providers	To assess the impact of integrating and scaling up PVT into routine MCH services on staff workload	None
20	Wanyu et al., 2007	2002–2005	Cameroon	Rural: community-based	TBA PVT training intervention; SSIs	30 TBAs	To evaluate the effectiveness of TBAs in delivery of PVT care	None

*Studies conducted in 2007 and later*

21	Agadjanian and Hayford, 2009	2008	Mozambique	Urban and rural: 6 public health centers	Participant observation, SSIs	2 CHW coordinators, 16 nurses, 4 CHWs	To characterize how integration of PVT services in MCH units shapes provider-client interactions and reproductive choices of HIV-infected women	None
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No.	Author(s), Year	Year conducted	Country	Setting <sup>d</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
22	Asefa and Mitike, 2014	2010	Ethiopia	Urban: 1 public hospital, 3 public health centers, 2 private hospitals, 2 private health centers	Surveys	31 nurses, midwives, public health officers, and physicians, 423 women seeking ANC	To characterize maternal satisfaction with PVT services and implementation challenges faced by providers	None
23	Chinkonde et al., 2010	2009	Malawi	1 peri-urban and 1 rural public PVT clinic	SSIs, participant observation	5 policymakers, 2 doctors, 8 nurses, 1 lay counsellor	To assess policymakers' and HWs' experiences with adapting and implementing global breastfeeding guidelines to national recommendations	None
24	Doherty et al., 2009	2007	South Africa	Rural: 18 public health centers	Quality improvement intervention; observation, surveys, workshops	15 center managers, 35 lay counsellors	To evaluate a participatory intervention seeking to improve quality of care in integrated PVT programs	Expanded health systems approach
25	Falnes et al., 2010	2007–2008	Tanzania	Urban and rural: 5 public clinics	Counselling observations, FGDs, IDIs, surveys	5 nurse counsellors (IDIs), mothers (in 4 FGDs, 8 IDIs, 311 surveys)	To characterize experiences of mothers and nurse counsellors during PVT	None
26	Geelhoed et al., 2013	2009–2010	Mozambique	Rural: 6 public health centers	Integration of PVT services intervention; service delivery statistics, SSIs	70 MCH providers	To assess the viability of integrated PVT care and follow-up of HIV-exposed infants	None
27	Hamele et al., 2014	2008	Malawi	Urban: 4 public PVT sites	TBA training intervention, log review, FGDs	21 TBAs	To evaluate the benefits of incorporating TBAs into HC-based PVT services	None
28	Horwood et al., 2010(A)	2007–2008	South Africa	Peri-urban and rural: 1 public health center and 1 public hospital	Surveys	25 nurses, 27 lay counsellors, 882 mothers	To evaluate implementation and integration of PVT with MCH. To describe the responsibilities of nurses and counsellors	None



No.	Author(s), Year	Year conducted	Country	Setting <sup>d</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
29	Israel-Ballard et al., 2014	2008	Kenya	12 public clinics <sup>a</sup>	Counselling observations, exit interviews, SSIs	80 mothers, 11 nurses/nutritionists	To evaluate how infant feeding counselors manage challenges encountered in delivery of care	None
30	Kim et al., 2013	2010	Zambia	Urban and rural: 8 military clinics	Observations, surveys	4 medical assistant, 10 clinical officers, 1 pharmacist, 14 nurses, 11 midwives	To evaluate provider performance for PVT and ART care and perception of work environment	None
31	Kwopong et al., 2014	2011	Ghana	Urban: 5 clinics <sup>a</sup>	FGDs, IDIs, surveys	12 nurses and midwives (IDIs), 40 pregnant women (5 FGDs), 300 pregnant women (surveys)	To characterize health center factors' influence on HIV testing and counseling during ANC to inform implementation	None
32	Labhardt et al., 2009	2007–2008	Cameroon	Rural: 62 public and private clinics and 8 public hospitals	Supply and equipment intervention; inventory, surveys	102 nurses	To evaluate effectiveness of intervention on equipment availability and staff PVT knowledge	None
33	Lippmann et al., 2012	2007	Malawi	Urban: community based	FGDs	17 TBAs (registered)	To assess the willingness and feasibility of TBAs to provide NVP to infants and mothers	None
34	Mnyani and McIntyre, 2013	2009	South Africa	Peri-urban: 10 public clinics	Surveys	44 nurses, 30 lay counsellors, 6 other HWs, 201 HIV-infected women	To assess quality of PVT care via the knowledge and experiences of HIV-infected women and HWs	None
35	Peltzer et al., 2010	2008	South Africa	Urban and rural: 44 public health centers including 5 hospitals	IDIs, register and records review, SSIs	31 program coordinators, 11 health center managers, 8 HWs	To assess challenges and proposed solutions to implementation of PVT care; to assess of clinic registers and health records	None
36	Rispel et al., 2009	2007	South Africa	Urban and rural: 3 hospitals and 20 clinics <sup>a</sup>	IDIs, surveys	20 PVT managers, 9 nurses, 18 lay counsellors, 4 maternity staff, 54	To assess missed PVT opportunities to inform evaluation of	Developed framework (based on Alma Ata Declaration, formative work)

No.	Author(s), Year	Year conducted	Country	Setting <sup>d</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
37	Rujumba et al., 2012	2010	Uganda	Rural and peri-urban: 10 public and private hospitals and health centers	IDIs, observation, SSIs	TBAs, 47 TMPs, 296 clinic users, 8 community organizations  2 doctors, 3 clinical officers, 15 nurses, 4 counsellors	program implementation  To characterize HW experiences in implementation in order to identify necessary steps to strengthen PVT service delivery	None
38	Sarker et al., 2009	2007	Burkina Faso	Rural: 4 public health centers	Counselling observations, IDIs	1 health officer, 1 PVT coordinator, 1 midwife, 6 counsellors, 16 pregnant women	To evaluate implementation of opt-in HIV testing services in the context of scaling-up PVT programming	None
39	Shayo et al., 2013	2011	Tanzania	Urban and rural: public and faith based <sup>e</sup>	FGDs, IDIs	22 HWs delivering PVT services, 11 district and regional managers, 10 health center PVT in-charges	To assess the priority setting process in planning the PVT program at district level	None
40	Sprague et al., 2011	2008–2009	South Africa	1 urban public hospital, 3 peri-urban public health centers	Health records review, IDIs	38 HWs (public health specialists, doctors, nurses, lay counsellors), 83 HIV-infected women, 32 caregivers of HIV-infected children	To characterize the barriers for patients and providers in the continuum of PVT care	None
41	Stinson and Myer, 2012	2007–2008	South Africa	Urban: 4 public primary health centers, 2 public hospitals	SSIs	3 service managers, 9 doctors, 1 nurse, 1 counsellor, 28 HIV-infected pregnant and postpartum women	To characterize barriers to initiating life-long ART during pregnancy and challenges to postpartum retention in HIV care	None
42	Turan et al., 2012	2009–2011	Kenya	Rural: 4 hospitals, 8 health centers <sup>d</sup>	Prospective cluster randomized controlled trial for service integration (HW training)	1,172 HIV-infected pregnant women	To evaluate the effects of integrating HIV treatment into ANC clinics	None
43	Uwimana et al., 2012(A)	2008	South Africa	Rural: public and private, 4 hospitals, 7 clinics, 5 NGOs	FGDs, IDIs	29 managers, 36 counsellors	To characterize managers' and CHWs' perceptions of barriers related to collaboratively implementing	None

No.	Author(s), Year	Year conducted	Country	Setting <sup>d</sup>	Study methodologies <sup>b</sup>	Participants <sup>c</sup>	Objective	Theoretical framework
44	Uwimana et al., 2012(B)	2008–2009	South Africa	Rural: public and private, 42 hospitals, 5 clinics, 33 NGOs	FGDs, household surveys, IDIs, NGO and health center audits	Health managers, 36 counsellors, 3,867 households	TB/HIV/PVT services To characterize NGO and CHW engagement in and barriers to collaborative implementation of integrated TB/HIV/PVT services	None
45	Vermooij and Hardon, 2013	2008	Uganda	Rural: 1 public clinic	SSIs, observations	2 PVT managers, 2 clinical officers, 2 midwives, 2 counsellors, 2 lab techs, 2 CHWs	To elucidate different HW cadres' perceptions and experiences in obtaining informed consent and conducting opt-out HIV testing in the context of PVT	Foucault's theory of governmentality
46	Watson-Jones et al., 2012	2008–2009	Tanzania	Urban: 3 public health centers, 2 public hospitals	Intervention for referrals; ANC observations, prospective cohort of HIV-infected women, surveys	30 HWs, 9 observations, 403 HIV-infected women	To evaluate the drop-out of care of HIV-infected women from the cascade of PVT services; to identify and characterize potential barriers to PVT service effectiveness	None
47	Yeap et al., 2010	2008	South Africa	Urban and rural: 6 private health centers	IDIs	7 doctors, 5 nurses, 9 counsellors, 3 care center staff, 21 caregivers	To describe the barriers and facilitators to uptake of HIV care among children	None

Notes:

<sup>a</sup>Unclear breakdown of urban/rural and/or public/private facility numbers

<sup>b</sup>Cross sectional unless otherwise noted

<sup>c</sup>Some specialized health workers were grouped into general cadres to streamline categorization; e.g. "doctors" included specialists (e.g. pediatricians and obstetricians) and "nurses" included professional and auxiliary nurses

**Technical abbreviations:** ART - anti-retroviral therapy; CHW - community health worker; HW - health worker; MCH - maternal and child health; NGO - non-governmental organization; NVP - nevirapine; PVT, prevention of vertical transmission; TB - tuberculosis; TBA - traditional birth attendant; TMP - traditional medical practitioner **Method abbreviations:** FGD - focus group discussion; IDI - in-depth interview; SSI - semi-structured interview

Table 2

An ecological analysis of frequency of barriers to delivery of prevention of vertical transmission of HIV (PVT) services, by the motivation-opportunity-ability framework (MOA)<sup>a</sup>

MOA Domain(s) <sup>b</sup>	Determinant of health worker performance	Manifestation	Studies conducted pre-2007 (n=20)		Studies conducted 2007-on (n=27)		Total studies (n=47)	
			n	%	n	%	n	%
Health worker factors								
M	Intrinsic motivation	Reported stress, burnout, depression	9	45.0%	9	33.3%	18	38.3%
A	Knowledge	Emotional burden of work (e.g. frustration of not effecting behavior change, infant HIV infection, patient hostility)	6	30.0%	6	22.2%	12	25.5%
A	Health worker approach to patient interactions	Poor understanding HIV transmission paths	7	35.0%	1	3.7%	8	17.0%
		Low general knowledge of health practices	2	10.0%	5	18.5%	7	14.9%
A	Health worker approach to patient interactions	Lack of consideration of patient needs and preferences	4	20.0%	5	18.5%	9	19.1%
		Language barriers between health worker and patient	1	5.0%	0	0.0%	1	2.1%
M	Extrinsic motivation	Inadequate remuneration (incl. late payment)	3	15.0%	5	18.5%	8	17.0%
		Other (e.g. low job security, fear of lawsuits)	2	10.0%	1	3.7%	3	6.4%
A	Poor self-efficacy	Lack of recognition (incl. few promotion opportunities)	2	10.0%	1	3.7%	3	6.4%
		Low confidence in knowledge, interpretation of protocols	2	10.0%	2	7.4%	4	8.5%
M	Beliefs	Discomfort diagnosing or counseling woman with HIV	4	20.0%	0	0.0%	4	8.5%
		Does not practice exclusive breastfeeding personally	2	10.0%	1	3.7%	3	6.4%
Patient factors								
O	Stigma influenced patient behavior at point of care	Stigma, generally (mechanism unspecified)	4	20.0%	10	37.0%	14	29.8%
		Patient hid HIV status during ANC or delivery	1	5.0%	10	37.0%	11	23.4%
		Patient refused HIV testing	3	15.0%	2	7.4%	5	10.6%
O	Patient hid actual (non-adherent) PVT behaviors (e.g. "unsafe" IYCF <sup>c</sup> )		1	5.0%	2	7.4%	3	6.4%

MOA Domain(s) <sup>b</sup>	Determinant of health worker performance	Manifestation	Studies conducted pre-2007 (n=20)		Studies conducted 2007-on (n=27)		Total studies (n=47)	
			n	%	n	%	n	%
<b>Work factors</b>								
O	Poor referral systems		7	35.0%	15	55.6%	22	46.8%
O	Unclear clinical IYCF guidelines (e.g. lack of existence, awareness) <sup>c</sup>		3	15.0%	7	25.9%	10	21.3%
O	Cumbersome record system (incl. high data volume, poor record-keeping)		0	0.0%	7	25.9%	7	14.9%
<b>Health facility environment</b>								
O	Over-burdened (e.g. understaffed, high workload, long hours)		12	60.0%	20	74.1%	32	68.1%
A	Inadequate PVT training		13	65.0%	14	51.9%	27	57.4%
O	Lack of supplies (e.g. HIV-specific medicines and tests, other medicines, contraceptives)		11	55.0%	16	59.3%	27	57.4%
A	Incorrect/inconsistent IYCF messages <sup>c</sup>		12	60.0%	8	29.6%	20	42.6%
O	Poor infrastructure		6	30.0%	8	29.6%	14	29.8%
	Lack of private and appropriately sized spaces for PVT counseling and child delivery		0	0.0%	3	11.1%	3	6.4%
	Inadequate laboratory equipment		1	5.0%	2	7.4%	3	6.4%
	Basics (e.g. water, electricity)		4	20.0%	9	33.3%	13	27.7%
A	Poor supervision (incl. feedback on performance)		2	10.0%	3	11.1%	5	10.6%
O	Inter-cadre issues encountered by lay and community-based health workers		2	10.0%	2	7.4%	4	8.5%
	Unclear roles		2	10.0%	2	7.4%	4	8.5%
	Poor relations between clinical and lay/community-based health workers		1	5.0%	1	3.7%	2	4.3%
A	Professional isolation		1	5.0%	1	3.7%	2	4.3%
<b>Administrative environment</b>								
O	Poor PVT planning and program coordination		5	25.0%	8	29.6%	13	27.7%
	Service fragmentation (e.g. separate of PVT and ANC clinics) and poor coordination between them		3	15.0%	4	14.8%	7	14.9%
	Lack of government funding for PVT		2	10.0%	4	14.8%	6	12.8%
	Poor planning for implementation or scale-up PVT		1	5.0%	2	7.4%	3	6.4%
	Poor allocation of equipment and supplies		2	10.0%	2	7.4%	4	8.5%
M	Lack of health system recognition for lay and community-based health workers		2	10.0%	2	7.4%	4	8.5%

MOA Domain(s) <sup>a</sup>	Determinant of health worker performance	Manifestation	Studies conducted pre-2007 (n=20)		Studies conducted 2007-on (n=27)		Total studies (n=47)	
			n	%	n	%	n	%
O	Foreign donors	Donor agenda discordant with country's needs	1	5.0%	3	11.1%	4	8.5%
		Supplies inconsistent	1	5.0%	3	11.1%	4	8.5%
A	Managerial issues	Manager did not understand socio-cultural context	0	0.0%	2	7.4%	2	4.3%
		Manager unaware of provincial guidelines	0	0.0%	1	3.7%	1	2.1%
		Did not address health worker concerns; poor communication	0	0.0%	2	7.4%	2	4.3%
Political and economic environment								
O	Health worker turnover, emigration to cities and high-income countries		1	5.0%	5	18.5%	6	12.8%

Notes:

<sup>a</sup>The ecological analysis expanded by study are available in Supplemental Table 2a for studies conducted prior to 2007 and in Supplemental Table 2b for studies conducted in 2007 and later

<sup>b</sup>MOA Domains: M - motivation; O - opportunity; A - ability

<sup>c</sup>IYCF - infant and young child feeding



Table 3

An ecological analysis of frequency of facilitators to delivery of prevention of vertical transmission of HIV (PVT) services, by the motivation-opportunity-ability (MOA) framework<sup>a</sup>

MOA Domain(s) <sup>b</sup>	Determinant of health worker performance	Manifestation	Studies conducted pre-2007 (n=20)		Studies conducted 2007-on (n=27)		Total studies (n=47)	
			n	%	n	%	n	%
Health worker factors								
M	Intrinsic motivation							
		Reward of effecting behavior change, patient health	7	35.0%	2	7.4%	9	19.1%
		Values work	4	20.0%	1	3.7%	5	10.6%
A	Feels knowledgeable about HIV practices		0	0.0%	3	11.1%	3	6.4%
M	Extrinsic motivation							
		Satisfied with remuneration (salary, incentives)	0	0.0%	2	7.4%	2	4.3%
		Others value importance of work	0	0.0%	1	3.7%	1	2.1%
		Professional development opportunities	0	0.0%	1	3.7%	1	2.1%
Patient Factors								
O	Health worker goes out of way to support patient interactions		4	20.0%	3	11.1%	7	14.9%
Work Factors								
O	Improved record system		2	10.0%	2	7.4%	4	8.5%
Health facility environment								
A	Quality training and regular refresher trainings		3	15.0%	3	11.1%	6	12.8%
A	Quality supervision (e.g. performance feedback, regular meetings)		2	10.0%	2	7.4%	4	8.5%
O	Consistent supplies		1	5.0%	3	11.1%	4	8.5%
O	Good staff relations, sense of teamwork		1	5.0%	1	3.7%	2	4.3%
O	Improved infrastructure							
		Updated equipment and facility	1	5.0%	1	3.7%	2	4.3%
		Private counselling rooms	1	5.0%	0	0.0%	1	2.1%
Administrative environment								

MOA Domain(s) <sup>b</sup>	Determinant of health worker performance	Manifestation	Studies conducted pre-2007 (n=20)			Studies conducted 2007-on (n=27)			Total studies (n=47)		
			n	%	n	%	n	%	n	%	
O	NGO support	Technical	2	10.0%	3	11.1%	5	10.6%			
		Financial	1	5.0%	2	7.4%	3	6.4%			
O	Non-clinical cadres delivered PVT services	Community health workers	1	5.0%	3	11.1%	4	8.5%			
		Lay counsellors	2	10.0%	0	0.0%	2	4.3%			
		TBAs referred women for clinical PVT care	0	0.0%	1	3.7%	1	2.1%			
		Quality PVT program coordination	1	5.0%	2	7.4%	3	6.4%			
O	Political and economic environment	Service integration for PVT	0	0.0%	1	3.7%	1	2.1%			
		Group HIV counselling	1	5.0%	0	0.0%	1	2.1%			

<sup>a</sup>The ecological analysis expanded by study are available in Supplemental Table 2a for studies conducted prior to 2007 and in Supplemental Table 2b for studies conducted in 2007 and later

<sup>b</sup>MOA Domains: M - motivation; O - opportunity; A - ability