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Systematic review of mobile-health behavioral interventions to improve uptake of HIV testing for vulnerable and key populations

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Abstract

Objective—This systematic narrative review examined the empirical evidence on the effectiveness of mobile health (mHealth) behavioral interventions designed to increase uptake of HIV testing among vulnerable and key populations.

Methods—MEDLINE/PubMed, Embase, Web of Science, and Global Health electronic databases were searched. Studies were eligible for inclusion if they were published between 2005 and 2015, evaluated an mHealth intervention, and reported an outcome relating to HIV testing. We also reviewed the bibliographies of retrieved studies for other relevant citations. The methodological rigor of selected articles was assessed, and narrative analyses were used to synthesize findings from mixed methodologies.

Results—A total of seven articles met the inclusion criteria. Most mHealth interventions employed a text-messaging feature and were conducted in middle- and high-income countries. The methodological rigor was moderate among studies. The current literature suggests that mHealth interventions can have significant positive effects on HIV testing initiation among vulnerable and key populations, as well as the general public. In some cases, null results were observed. Qualitative themes relating to use of mobile technologies to increase HIV testing included the benefits of having low-cost, confidential, and motivational communication. Reported barriers

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Conflicts of Interest:

There are no conflicts of interest.

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included cellular network restrictions, poor linkages with physical testing services, and limited knowledge of appropriate text-messaging dose.

Conclusions—MHealth interventions may prove beneficial in reducing the proportion of undiagnosed persons living with HIV, particularly among vulnerable and key populations. However, more rigorous and tailored intervention trials are needed to assess the effectiveness of widespread use.

Introduction

Despite prevention successes in scaling up HIV testing services (HTS), the Joint United Nations Programme on HIV/AIDS (UNAIDS) estimates that roughly half of people infected with HIV in the world are unaware of their HIV status as a result of insufficient levels of HIV testing in populations most at risk of HIV (1–3). Knowledge of one's HIV status is a crucial step in accessing HIV care and initiating antiretroviral therapies early, which has been shown to reduce transmission of HIV (4). Learning that one is infected with HIV can also lead to reductions in sexual risk behaviors, such as inconsistent condom use and multiple sexual partners which contribute to the spread of the virus (5–13). However, there are several barriers to HIV testing, including fear of negative consequences, discrimination, and perceived low risk of acquiring HIV, as well as lack of knowledge regarding free or low-cost testing and treatment options (14–18). Other barriers to HIV testing include fear of breaches in confidentiality at testing sites, test costs, and uncertainty about where to go for testing (19–21). Individuals seeking HTS may also remain unaware of their status if return visits are not completed (22). As new UNAIDS goals seek to ensure that 90% of all people with HIV are diagnosed by 2020, innovative interventions are needed to improve uptake of HTS (2).

Mobile health (mHealth) strategies representing use of mobile technologies, such as mobile phones, personal digital assistants, and other wireless devices to support medical and public health practice, can be an innovative approach to increase HIV testing rates (23–25). There are approximately 5 billion mobile phone subscriptions in the world (26). Because such a large number of individuals use mobile phones, mHealth behavioral interventions have been implemented and evaluated in low- and middle-income countries to improve HIV care outcomes relating to antiretroviral initiation and adherence (27–30).

MHealth interventions may also hold promise for increasing awareness and initiation of HIV testing (25), particularly among high-risk populations, such as vulnerable and key populations with high rates of not yet diagnosed HIV infection (1). As mobile phone text messaging has been shown to promote patient-physician communication, text messages providing information on HIV testing may encourage high-risk individuals to seek community or clinic-based HTS (23, 25, 31). Mobile phone text messaging may also be an effective tool to improve HIV testing self-efficacy given that information can be personalized and interactive (23). Previous reviews (32–38) have examined use of mobile phone technologies in HIV prevention and treatment, but have not specifically examined the effectiveness of mHealth interventions on uptake of HIV testing. As a result, questions remain about the unique capacity of mobile technologies to improve testing rates among

populations most-at-risk for HIV. To answer this question, this systematic narrative review examined the current literature of mHealth interventions aimed at increasing HIV testing with a specific focus on vulnerable and key populations. We discuss the evidence to-date and implications for future research and practice.

Methods

Search Process

MEDLINE/PubMed, Embase, Web of Science, and Global Health electronic databases were searched to identify manuscripts evaluating HIV testing mHealth strategies in biomedical and social science databases. These databases were selected to cover a wide range of disciplines, from social sciences to interdisciplinary to biomedical research. A combination of search terms relating to mobile phones, testing, and HIV were used [Table 1]. We also reviewed the bibliographies of retrieved full text studies for other relevant citations.

Inclusion Criteria

Studies were eligible for inclusion if they were: (i) an evaluation of a behavioral intervention using mobile technology (i.e., text messaging, calls, mobile web, or mobile apps) either as a component or stand-alone strategy; (ii) reported an outcome relating to uptake of HIV testing; (iii) available in the English language; and (iv) published between January 1, 2005 and August 1, 2015. We excluded internet-based, online, and social media interventions that were not mobile-based strategies, as well as conference abstracts and posters. In addition, given the expansion of rapid screening tests and the imperative to target individuals with unknown serostatus (1, 39, 40), we only included articles examining mobile technologies to improve HIV test initiation which we defined as the first test encounter by an individual to determine HIV serostatus (1). We excluded studies examining mobile technologies to improve test turnaround times, clinic returns for test results, or notification of test results. Studies targeting HTS for all ages and in all settings were eligible for inclusion.

Full Text Review

All articles were initially screened by two reviewers who independently examined the titles and abstracts of studies to accept or reject for full text review. The same two reviewers then independently reviewed the full text articles to confirm eligibility. Data were extracted from eligible studies relating to the following characteristics: author, year, country, intervention objective, mobile phone type, non-mobile components, study design, participant sample, effectiveness on HIV testing, and author mHealth recommendations. A quality assessment was conducted for each article based on published guidelines for assessing the rigor and risk of bias in research studies (41–44). Findings were interpreted and discussed taking into account the study design. In order to examine all literature, no studies were excluded based on quality assessments.

Analysis

We conducted a narrative analysis, summarizing quantitative and qualitative evidence, of the studies given the broad range of intervention strategies, target groups, and outcome measures for test initiation. Narrative analyses are appropriate for reviews involving mixed

methodologies (45, 46). In addition to summarizing reported quantitative changes, we used an inductive approach to identify qualitative themes on effectiveness of implementation across three target populations which we defined as: (i) *vulnerable populations*, representing individuals which a high burden of and/or risk of exposure to HIV, such as pregnant women, racial and ethnic minorities, displaced persons, as well as children and sexual partners exposed to HIV (47–49); (ii) *key populations*, representing individuals most-at-risk for HIV, such as injection drug users, MSM, incarcerated persons, transgender people, and sex workers (1); and (iii) *general populations*, including interventions targeting the broad public (not specifically vulnerable or key populations) within a defined geographic region. We read each article several times and coded findings that were then consolidated into larger themes.

Results

Selected Articles

We retrieved 23 full-text articles from 564 potentially relevant citations based on review of the article's title and abstract (Figure 1). Following a full-text review for eligibility, 7 articles were retained for analysis: Agarwal 2015 (50), Bourne 2011 (51), Burton 2013 (52), de Tolly 2012 (53), Odeny 2014 (54), Udeagu 2014 (55), and Zou 2013 (56). The majority of studies utilized mobile phone text-messaging (or short message service, SMS) and calling features to target HIV testing (Table 2). There was considerable variation in type of indicator and assessment durations used (Table 3). Several studies relied on quasi-experimental designs with risks of biases relating to follow-up and outcome assessments (Table 4). Two studies utilized qualitative methods and reported verbatim textual data to confirm their findings.

Vulnerable Populations

Two of the seven selected articles targeted vulnerable populations. A randomized controlled trial (RCT) in Kenya compared the proportion of HIV-positive mothers (n=388) returning to clinic for virological infant HIV testing at 8 weeks postpartum among women receiving 14 HIV-neutral infant immunization SMS messages compared to HIV-positive women in usual care (no SMS) (54) (Table 3). HIV infant testing was significantly higher among SMS-messaged women (92%) as compared to non-messaged women (85%, $p<0.05$; OR=1.08, 95% CI:1.00–1.16) (54). The second intervention was developed for sex partners of recently HIV-diagnosed patients (n=3,247) in the United States (55). This quasi-experimental study examined the proportion of HIV-exposed sex partners with negative or unknown serostatus who, in turn, underwent HIV testing. Results showed that HIV testing among sex partners was significantly lower in those receiving text-messaged partner notification (PNS) services (45%) compared to traditional PN services (i.e., postal mail, landline calls, field visits) (69%, $p<0.0001$) and no different in comparison to internet-based PN services (34%, OR=0.7, 95% CI:0.40–1.50) (55).

Key Populations

Four studies were dedicated to key populations, usually MSM. Three studies evaluated stand-alone mobile phone health interventions, although they were limited by selection biases from non-randomized trial designs. Among MSM who had undergone an initial HIV

test (n=1,753), a quasi-experimental trial in Australia compared the proportion of repeat HIV testing among those receiving a 4-month SMS reminder compared to MSM who did not receive the reminder (51) (Table 3). Over half (64%) of text-messaged MSM clients initiated a second test in the nine months prior compared to non-messaged MSM (30%, $p<0.001$), and they were 4.3 times more likely to do so (OR=4.3, 95% CI:3.5, 5.2) (51).

In a single-group post-intervention assessment in India, the authors qualitatively reported that a small proportion (no statistics provided) of MSM who called into an MSM-dedicated helpline reported getting an HIV test due to the helpline's referral compared to 30% of MSM callers who had been tested for HIV at baseline (50). The MSM helpline was accessible daily, all-day, and provided information on HIV prevention and testing with the option of phoning a counselor, listening to an interactive voice response (IVR), or receiving an SMS (50). Another intervention in the United Kingdom sent SMS reminders to sexual health clinic attendees (n=539) at high risk for HIV approximately 2 to 12 weeks following their initial visit, targeting key populations (MSM patients and commercial sex workers) as well as vulnerable populations (women receiving emergency contraception and persons with prior STI diagnosis) (52). Using a quasi-experimental design, the authors found no significant differences in the proportion of text-messaged (33%) versus non-messaged clients (35%, $p>0.05$) who returned for a repeat HIV/STI test in the following four months (52).

The fourth key populations' intervention targeted adult MSM in China (n=3,332) and combined mobile phone calling with online outreach and financial incentives (56). This quasi-experimental trial identified MSM on gay partner-seeking websites and invited them for HIV testing using mobile phone, email, instant messaging, or chat room follow-up. Based on descriptive statistics, the percent attendance at local VCT clinics for HIV testing was higher for MSM invited for testing by mobile phone (8.3%) compared to those contacted by email (4.3%), but lower compared to MSM invited by instant message (11.5%) and chat room follow-up (20.1%) (56).

General Populations

One study in South Africa evaluated an intervention geared towards the general public. This RCT incorporated qualitative research methods and randomized mobile phone-competition subscribers (n=2,533) to one of four text-messaging conditions over the course of 4 to 8 weeks to prompt HIV test-seeking (53). Mobile users receiving 10 motivational (MOTI) HCT texts were 70% more likely to report having tested for HIV (OR=1.70, 95% CI:1.19–2.44) since the start of the intervention compared to control participants (no text messages) (53). However, no significant differences were observed for mobile users receiving 3 MOTI texts (OR=0.73, 95% CI:0.53–1.01), 10 informational texts (OR=1.05, 95%CI:0.77–1.44), or 3 informational texts (OR=0.92, 95% CI:0.66–1.27) as compared to control. Qualitative findings for non-HCT were lack of time, inaccessible testing sites, and fear of results.

Emerging Themes from Selected Articles

Several of the selected studies reported on the overall benefits of the mobile phone-based strategy in providing low-cost customizable and confidential communication (50, 51, 53,

54). One common theme was that mobile phone-strategies were more easily implementable by health care systems, provided that only minimal and low-literacy technology was used (55). However, despite introducing interventions within health systems, user costs to send and receive text messages were often prohibitive (53, 54). A second theme was that intervention effectiveness was sometimes hindered by telephone regulatory and infrastructural barriers. For example, Agarwal (50) found that fewer callers used the text-message option compared to calls because text messages were not free and the service was blocked by “do not disturb” registrations. Bourne (51) also attributed lower use of SMS reminders by clinicians to their being separate from the electronic health record and therefore easy to omit.

A third theme related to the difficulty of linking mobile phone-based HTS messages or calls to HTS sites in geographical proximity of the user. For example, in India, while calls entered the helpline nationwide, the directory of HTS was available in only three states (50). Similarly in Australia, the authors noted that despite using a mobile phone strategy, measuring the effectiveness of the intervention required tracking HIV testing at physical sites, which was not always feasible (51). In South Africa and China, respectively, participants who received the HTS prompts also complained of having few testing sites available outside of normal business hours (53) or not knowing where HTS sites were located (56).

There were four less common themes. One was that mobile phone strategies should be testable for participants at various stages of use. For example, Agarwal (50) found that Indian users initially called the MSM hotline without speaking in order to confirm its confidentiality. A second less common theme related to the importance of intervention quality maintenance. For example, mystery callers with pre-determined questions were used in India to assess services received by MSM hotline callers (50). As a third less common theme, Burton (52) suggested that SMS reminders may have been more effective if they had come from a recognized clinic and had been more tailored and interactive for clients. Finally, being able to identify the minimally effective dosage of mobile content was also considered important (52–54).

Discussion

To our knowledge, this is the first narrative review to focus solely on use of mobile technologies to improve uptake of HIV testing. Despite a proliferation of mHealth strategies geared towards HIV, we identified a relatively small number of studies targeting initiation of testing in not yet diagnosed individuals. Among these, more than half of the studies reported a significant increase in HIV testing as a result of mobile phone stand-alone and integrated strategies (51, 53, 54, 56). Positive effects on HIV test initiation were observed among mHealth interventions in vulnerable (54), key (51, 56), and general populations (53), although not all high-risk sub-groups were included. Our review did not identify mHealth HIV testing interventions addressing test gaps among injection drug users, transgender individuals, or homeless youth who are all disproportionately infected. Reaching the UNAIDS goal of 90% diagnosis of all persons with HIV may be enhanced by leveraging mobile technologies to improve uptake of HTS for all high-risk populations.

Several implications emerged from this review. One relates to the geographic emphasis of mHealth testing interventions. Despite the high burden of HIV, low uptake of HTS, and high access to mobile phones in sub-Saharan Africa (57, 58), the majority of applicable studies were conducted in middle- and high-income countries. However, the only two African studies found that mobile-based HIV testing initiatives can be delivered successfully within the region with reported significant positive outcomes. This suggests that more efforts are needed to test and scale-up mHealth HIV testing initiatives in African settings.

Another implication relates specifically to use of text messages to increase HIV testing uptake, as this was the most common mHealth delivery mode. Several studies relied on text messages to encourage HIV testing among targeted groups, although only one study examined the comparative effectiveness of various types of text-messaged formats (53). Previous research has suggested that motivational text messages can be used to address barriers to testing uptake, such as fear of knowing one's status or lack of knowledge regarding the HIV testing process (59). Studies have also suggested that timing and frequency of tailored text messaging can significantly impact outcomes (53, 60, 61). Findings from this review indicate that less is known regarding the optimum format and frequency of text messages to address low rates of HIV testing as most studies evaluated only one strategy. As more mHealth intervention rely on text messages to reach undiagnosed persons with HIV, it will be critical to tailor mobile content and delivery to local needs and understand factors that may influence the effectiveness of text-based promotion of HTS.

Of important note is the interpretation of the mixed and null results observed in this review. In some cases, mobile phone-based interventions were less effective in increasing HIV test initiation as compared to online strategies or in-person usual care conditions. These findings imply that the ability of mobile health technologies to increase HIV test initiation in all populations may be limited, particularly among individuals who prefer health communication via online, in-person, or social media networks. We also observed among studies that some barriers to HIV test initiation, such as stigma, inconvenient HTS hours, and cellular network restrictions were less amenable to text-messaged approaches and may benefit from broader mHealth inputs.

More rigorous study designs are needed to fully assess the effectiveness of mobile phone strategies on uptake of HIV testing, building on attributes of quantitative and qualitative research methods. Our findings were limited by the quality of available studies which included several single-group and quasi-experimental designs. Therefore, the review's findings should be considered with this in mind. Interpretation was also hindered by incomplete outcomes reporting (i.e., proportions, ratios). It was not always possible to distinguish between testing for HIV testing versus HIV and other STIs. Some authors reported also that measurement of HIV testing was limited by an inability to follow mHealth users to physical testing sites.

Nonetheless, this review provides a preliminary narrative on the potential of mHealth strategies to improve HIV testing in high prevalence settings in order to decrease the proportion of undiagnosed persons living with HIV. We found that mobile phone strategies were moderately effective among vulnerable and key populations, although more

information is needed to improve effectiveness of tailored text-messaged approaches and use of other mobile- and non-mobile intervention components to address low testing rates. Mobile network restrictions, potential insufficient dose, and preference for non-mobile HIV testing information remain as barriers to effective and widespread use.

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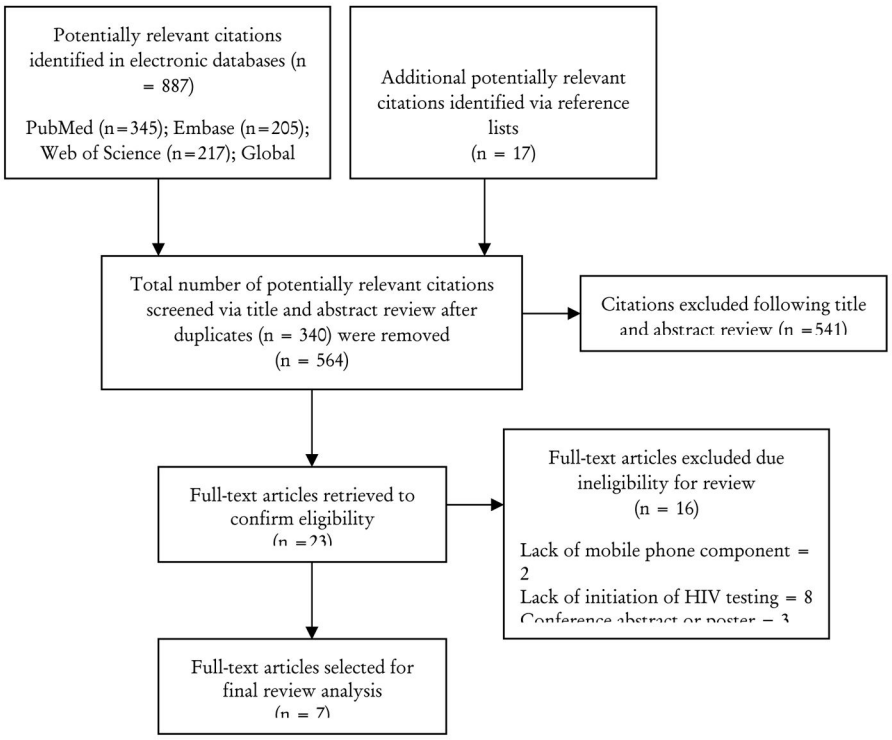

Figure 1.
Summary of search results identifying potentially relevant, screened, and selected articles

Table 1

Overview of search categories and terms

Electronic database	**MEDLINE/PubMed, Embase, Web of Science, Global Health**		
Search category	**Mobile [AND]**	**Testing [AND]**	**HIV**
Search terms	“mobile phone(s)“ OR “mobile devices“ OR “cell phone(s)“/[mesh] OR “cellular phone(s)” OR “smart phone(s)“ OR “smartphone(s)” OR “SMS“ OR “text“ OR “text messaging”/[mesh] OR “mHealth” OR “telemedicine”	“tested” OR “testing” OR “test(s)”	“human immunodeficiency virus“ OR “HIV” OR “STI” OR “sexually transmitted“ OR “acquired immunodeficiency syndrome“[mesh]

Table 2

Characteristics of research articles eligible for inclusion

First Author, Year, Ref #] (Country)	Intervention Objective	Mobile Phone Type				Non-Mobile Phone Add-Ins	Study Design				Sample	Effectiveness on HIV Testing	
		Text/SMS	Calling	App, m-web	IVR		Qualitative	Single-group Time Series	Quasi-Experimental	Experimental		Positive	Negative or Null
Agarwal 2015 [49] (India)	To evaluate effect of a MSM-dedicated helpline accessible by calling-in 24 hours, 7days/week for information on HIV/STI prevention, testing/referrals, symptoms, condom use, and treatment from a trained counselor, IVR, or text message.	X	X		X	None	X	X			Underserved MSM (n=39,800)	Qualitatively reported that small proportion of callers indicated receiving HIV test based on helpline referrals.	None
Bourne, 2011 [50] (Australia)	To evaluate efficacy of an SMS re-testing reminder sent 4-months post- HIV/STI test on HIV/STI re-testing rates compared to usual care (no SMS) for HIV tested clients.	X				None			X		MSM who underwent initial HIV/STI testing (n=1,753)	Found significant higher HIV/STI re-testing in SMS group compared to usual care with similar baseline re- testing rates	None
Burton, 2013 [51] (United Kingdom)	To evaluate efficacy of SMS text reminder sent 2 to 12 weeks sexual health clinic attendance on HIV/STI re-testing (re-attendance) rates among clinic attendees compare to usual care (no SMS).	X				None			X		Sexual health clinic attendees, vulnerable and key groups (n=539)	None	No significant differences in HIV/STI retest rates were found.
de Tolly, 2012 [52] (South Africa)	To evaluate efficacy of 3- or 10-informational or motivational SMS prompts every 3 days to undergo HCT as compared to usual care (no SMS).	X				None	X			X	Mobile phone competition subscribers in general public (n=2,533)	Significant positive results among most intensive motivational SMS group vs. control.	No significant differences in less intense or informational SMS vs. control.
Odeny, 2014 [53] (Kenya)	To evaluate efficacy of receipt of 14 antenatal and postnatal SMS messages on virological infant HIV testing at 8 weeks postpartum as compared to usual care (no SMS).	X				None				X	HIV-positive pregnant women (n=388)	Women receiving HIV- neutral infant immunization SMS were significantly more likely to return for HIV infant testing than women not receiving SMS.	None
Udeagu, 2014 [54] (USA)	To evaluate efficacy of SMS text-based partner notification services on partner HIV testing as	X	X			In-person or email partner notification			X		Sex partners of recently HIV-diagnosed patients (n=3,247)	None	SMS partners significantly less likely to test for HIV compared to

First Author, Year, Ref #] (Country)	Intervention Objective	Mobile Phone Type				Non-Mobile Phone Add-Ins	Study Design				Sample	Effectiveness on HIV Testing	
		Text/SMS	Calling	App, m-web	IVR		Qualitative	Single-group Time Series	Quasi-Experimental	Experimental		Positive	Negative or Null
	compared to traditional and internet-based partner services.					of HIV exposure							partners with traditional notification. No difference compared to Internet.
Zou, 2013 [55] (China)	To evaluate active internet outreach with mobile phone, email, instant messaging, or chat room follow-up on HIV testing as compared to passive internet outreach.		X			Online out-reach and financial incentive			X		MSM, Aged 18 or older (n=3,332)	Descriptive sub-analyses show higher HIV testing with mobile phone contact vs. email contact.	Descriptive sub-analyses show lower HIV testing with mobile contact vs. chat room or instant message contacts.

Table 3

Reported efficacy of mobile-based behavioral intervention on related HIV testing outcomes by article

First Author, Year, Ref [#], (Country)	Indicator	Time Period	% HIV Test Uptake					Common Qualitative Themes
			Intervention [I1] (n,%)	Comparison [C1] or Time Series [Is] (n,%)	Difference [I-C] (%)[I0 – I1] (%)	Reported Crude OR, RR [95%CI]	Reported Adjusted OR, RR [95%CI]	
Agarwal 2015 [49] (India)	% of callers reporting to have been HIV tested in last one year	9 months	30%	NR	NR	None	None	• Scalable for hard-to-reach groups • Testable in stages of use • Regulatory/ infrastructural barriers • Requires quality control • Variable links to local HCT sites
Bourne, 2011 [50] (Australia)	% of HIV/STI tested clients receiving 2nd test in 9 months	9 months	64%	30%	+26% * (p<0.001)	OR=4.3 * [3.5, 5.2]	OR=4.4 * [3.5, 5.5]	• Scalable for hard-to-reach groups • Regulatory/ infrastructural barriers • Variable links to local HCT sites
Burton, 2013 [51] (United Kingdom)	% of SH clinic attendees returning for HIV/STI testing in 4 months	4 months	33%	35%	−2% (p>0.05)/NS	None	None	• Importance of interactive style • Need to determine minimum dose
de Tolly, 2012 [52] (South Africa)	% of mobile users reporting having tested for HIV since	4 – 8 weeks	NR	NR	NR	OR=1.70 * [1.19–2.44] OR=0.73 [0.53–1.01] OR=1.05 [0.77–1.44] OR=0.92 [0.66–1.27]	None	• Scalable for hard-to-reach groups

First Author, Year, Ref [#], (Country)	Indicator	Time Period	% HIV Test Uptake					Common Qualitative Themes
			Intervention [I1] (n,%)	Comparison [C1] or Time Series [Is] (n,%)	Difference [I-C] (%)[I0 – I1] (%)	Reported Crude OR, RR [95%CI]	Reported Adjusted OR, RR [95%CI]	
	intervention start (10-MOT, 3-MOT, 10-INFO, 3-INFO vs. control, respectively)							• Variable links to local HCT sites • Not always free/cheap for users • Need to determine minimum dose
Odeny, 2012 [53] (Kenya)	% HIV-positive mothers returning for virological infant HIV testing at 8 weeks postpartum	20 weeks	92%	85%	+7% * (p<0.05)	RR=1.08 * [1.00–1.16]	None	• Scalable for hard-to-reach groups • Not always free/cheap for users • Need to determine minimum dose
Udeagu, 2012 [54] (USA)	% sexual partners exposed to HIV with negative or unknown serostatus who tested for HIV (text vs. internet, text vs. traditional)	~ 2 years	45%	34%, Internet 69%, Traditional	+9%, vs. Internet −24% *, vs. Traditional (p<0.0001)	$OR_{text\ vs.\ Int}$ =0.7 [0.4–1.5] $OR_{text\ vs.\ trad}$ = NR $OR_{Int\ vs.\ trad}$ = NR	None	• Scalable for hard-to-reach groups • Implementable for health systems
Zou, 2013 [55] (China)	% attendance at local VCT clinic for HIV testing	Not specified	8.3%	4.3%, Email 11.5%, IM 20.1%, Chat	+4.0%, vs. Email −3.2%, vs. IM −11.8%, vs. Chat	None	None	• Variable links to local HCT sites

NR = Not reported by authors;

* p<0.05

Table 4

Quality assessment of methodological rigor and risk of bias by study

	Quantitative Methods						Qualitative Methods				
First Author, Year, [Ref#]	**Pre-/post-measures of outcome(s)**	**Use of control or comparison group**	**Comparison group selected from similar population**	**Random assignment of individuals to intervention**	**Response or follow-up rate > 80%**	**Masked outcome assessment**	**Prolonged engagement in study setting**	**Methods justification**	**Confirmable by verbatim textual data**	**Member verified**	**Reflexive account provided**
Agarwal 2015 [49]	No	No	No	No	Yes	No	Yes	Yes	No	Yes	No
Bourne 2011 [50]	No	Yes	Yes	No	No	No	--	--	--	--	--
Burton 2013 [51]	Yes	Yes	Yes	No	No	No	--	--	--	--	--
de Tolly 2012 [52]	No	Yes	No	Yes	No	No	Yes	Yes	Yes	No	No
Odeny 2014 [53]	No	Yes	Yes	Yes	Yes	No	--	--	--	--	--
Udeagu 2014 [54]	No	Yes	No	No	No	No	--	--	--	--	--
Zou 2013 [55]	No	No	No	No	Yes	No	--	--	--	--	--