



REVIEW

Behavioral interventions promoting HIV serostatus disclosure to sex partners among HIV-positive men who have sex with men: a systematic review

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Abstract

Objectives This review aimed to identify intervention components which were effective to promote disclosure of HIV status among men have sex with men (MSM) living with HIV, particularly from a theoretical perspective.

Methods A systematic review was performed through searching electronic databases, HIV-related conferences websites, and registered ongoing randomized controlled trials. Studies were included if they reported intervention evaluation results related to HIV disclosure and published before December 31, 2017. Two independent reviewers collected studies and extracted data.

Results Eight studies met the inclusion criteria and were summarized. Interventions appeared effective in promoting HIV disclosure to their sex partners among MSM living with HIV if they were theory based (e.g., consequence theory and social cognitive theory). Key elements of effective interventions consisted of increasing disclosure self-efficacy, highlighting disclosure benefits, assisting risk assessment, developing disclosure strategy, and using messages under social influence.

Conclusions Findings of this review imply that future interventions are more likely to succeed if they apply consequence theory, social cognitive theory, and trans-theoretical model of behavior change and include multiple key intervention components.

Keywords Disclosure · HIV · Intervention studies · Men who have sex with men · Systematic review

Introduction

World Health Organization estimated that 36.7 million people were living with HIV, and 1.0 million died of HIV-related illnesses worldwide in 2016 (Serovich 2001; World Health Organization 2017). HIV/AIDS is recognized as one of the leading diseases for global disease burden (World Health Organization 2017). Around 50% of all new HIV infections worldwide occur among key populations, which include men who have sex with men (MSM) (Joint United Nations Programme on HIV/AIDS 2017). MSM is the only subgroup showing a continuous increasing trend in the HIV epidemic (Zhang et al. 2013).

Numerous factors result in risky sexual behaviors that contribute to this sustained HIV epidemic among MSM; factors include stigma, social barriers, lack of HIV prevention knowledge, and poor HIV risk awareness (Hall et al. 2008). Defined as the process of revealing a person's HIV status (Obermeyer et al. 2011), HIV disclosure is

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effective in reducing risky sexual behaviors, and thus decreasing HIV transmission risk among MSM (Pinkerton and Galletly 2007). It was estimated that disclosure of HIV status is able to reduce the risk of HIV transmission by 18–41% (Pinkerton and Galletly 2007). HIV disclosure can benefit MSM living with HIV in terms of improving ART adherence, increasing social support, and reducing psychological distress (Chaudoir et al. 2011; Wohl et al. 2011). However, the rate of disclosure to sexual partners was low (12–53%) (Carballo-Diéguez et al. 2006; Hart et al. 2005; Klitzman et al. 2007; Wei et al. 2012) and varied across individual, interpersonal, and situational factors (Sullivan 2005). Examples of these factors were self-efficacy for disclosure, intimacy with the partner, and the place to have sex (Carballo-Diéguez et al. 2006; Hart et al. 2005; Klitzman et al. 2007; Wei et al. 2012).

The low disclosure rate and high transmission risk to the HIV-negative partner demand a closer look at the data to identify effective behavioral interventions. HIV disclosure can be seen as a promising behavioral indicator to be altered by behavioral interventions, as a meta-analysis showed that behavioral interventions can reduce various risky sexual behaviors among MSM including unprotected sex and multiple sex partnerships (Johnson et al. 2002). Previous studies suggested some key points that contributed to the success of the intervention, for example, critical intervention components should include both information and motivation (Fisher and Fisher 1992), skills needed in behavior change should be trained (Choi and Coates 1994), and sufficient resources should be available during the adoption process of intervention (Holtgrave et al. 1995).

There were a few behavioral intervention programs aimed to facilitate HIV disclosure to sexual partners among MSM; however, we identified three knowledge gaps in the existing literature. First, the effectiveness of these interventions varied substantially (Milam et al. 2016; Wolitski et al. 2005). For example, an internet-delivered trans-theoretical model of behavior change-based intervention was effective in increasing disclosure among MSM living with HIV (Milam et al. 2016). However, an HIV-positive peer-delivered social cognitive theory-based intervention failed to produce such effect (Wolitski et al. 2005). This heterogeneity of effect may be due to the content (e.g., the theoretical base and key messages delivered) and format of the intervention (e.g., the mode of delivery, the type of implementer, and the duration and frequency of the intervention) (Gearing et al. 2011; Michie et al. 2008). Second, a detailed review of the disclosure measure is lacking depending on the recipient's characteristics. There is evidence that disclosure may have different causes and consequences depending on the types of the recipient (e.g., regular vs. casual partner) and on the discloser's awareness

on the recipient's HIV status (positive, negative, or unknown) (Dima et al. 2014). Third, some studies failed to assess the intervention effect on disclosure behavior in a proper time-bound manner. It takes time to make the disclosure decision and requires developed skills to perform the disclosure. A separate assessment of the intervention's immediate effect and prolonged effect is meaningful.

Interventions informed by behavioral theories are more likely to succeed in changing behaviors than non-theory-based ones (Michie et al. 2008). Three main theories applied in the domain of HIV disclosure were identified in the literature, including consequence theory (CT), social cognitive theory (SCT), and trans-theoretical model of behavior change (TTM). CT states that the people living with HIV (PLWH) are more likely to disclose HIV status once the rewards for disclosing outweigh the costs of disclosing (Serovich 2001). CT tested its first application in a qualitative study of 42 HIV-positive individuals (Derlega et al. 1993) and thereafter reported in four quantitative studies with supportive evidence (Parsons et al. 2004; Serovich 2001; Serovich et al. 2008; Zea et al. 2007). SCT states that disclosure is not an exclusive behavior determined solely by the patients, but also influenced by the surrounding persons and environments (Bandura 1986). SCT has been tested in various studies related to HIV disclosure decisions (Abler et al. 2015; Semple et al. 1999). TTM, also known as stages of change model (Prochaska and DiClemente 1983), believes that change of health behaviors consists of an ordered set of stages, and people in different stages have different needs and barriers that need to be matched with specific strategies.

The aim of this systematic review was to identify effective intervention components in promoting HIV-positive status disclosure among MSM living with HIV, particularly from the perspective of the theory applied in the intervention. Findings from this review may inform future programs design so as to support MSM living with HIV with the disclosure decision/process.

Methods

Criteria for selecting studies

Studies

We reviewed studies based on types of participants (MSM) and interventions (behavioral interventions). We reviewed studies for relevance based on the inclusion of specified outcome measures (HIV disclosure proportion/events), and for methodological rigor based on study design [randomized controlled trials (RCTs)].

Participants

We targeted MSM living with HIV in the current review. MSM were defined by sexual behavior, regardless of self-identified sexual orientation, age, race/ethnicity, gender identity, and nationality. Studies conducted only among other subpopulations were excluded from the current review. If mixed target groups (MSM and other subpopulations) were included, we only obtained outcome data for the MSM subset when relevant data were available. Studies that conducted among MSM living without HIV were excluded. If mixed samples (men living with and without HIV both) were included, we used outcome data for the subset living with HIV only if such data were available.

Interventions

Behavioral interventions implemented to promote HIV disclosure, with or without other outcome indicators (i.e., condom use), were included. Such interventions could be based on any behavioral theory or non-theory based. We excluded biomedical or pharmaceutical interventions.

Outcome measures

Dichotomous measures reflect the proportion of respondents reporting any disclosure event during the study period. Count-level outcomes reflect the number of disclosure events during the study period. The behavioral intention to disclose HIV-positive status was also considered as the outcome indicator. The disclosure targets should include at least (either male or female) sex partners, with or without other targets (e.g., family, friends).

In addition, we excluded studies if they were a review, letters to editors, non-peer-reviewed local or government report, diagnostic laboratory tests, case reports, or master or doctoral theses. We further excluded duplications.

Search strategy for identification of studies

A systematic electronic search was performed by the first and second authors in the following databases from the date of establishment until December 31, 2017: Databases included are MEDLINE, PsycINFO, PubMed, AIDSLine, Web of Science, EMBASE, Social Science Citation Index, Applied Social Sciences Index and Abstracts, Cochrane Central Register of Controlled Trials, The National Research Register, and Computer Retrieval of Information on Scientific Projects.

We further searched websites of major HIV-related conferences for relevant abstracts (the International AIDS Conference, the Conference on HIV Pathogenesis, Treatment, and Prevention, and the Conference on Retroviruses

and Opportunistic Infections). The conference abstracts were searched for all available years.

We also searched for ongoing RCTs through clinicaltrials.gov, PROSPERO (International prospective register of systematic reviews), and WHO International Clinical Trials Registry Platform. We also reviewed prior systematic reviews and their references. We did not restrict searches by country. Only publications in English were included in the present review.

Keywords included four sets as follows:

1. “men” or “men who have sex with men” or “homosexual men” or “gay” or “men who have sex with men and women” or “bisexual men” or “sexual minority” or “male”; AND
2. “HIV-positive” or “HIV infected” or “Human Immunodeficiency Virus” or “HIV/AIDS” or “HIV” or “AIDS”; AND
3. “disclose” or “disclosure” or “partner notification” or “tell” or “contact tracing” or “ask” or “know” or “notify”; AND
4. “intervention” or “program” or “randomized control trial” or “follow-up studies” or “RCT” or “pilot”.

Data extraction

The following information was obtained from each included study:

1. Study information: investigation date, place, study design;
2. Participants: N, sampling methods;
3. Intervention: N, components, who delivered the intervention, format, duration, and guided theory;
4. Outcome variable: measures, disclosure targets; and
5. Intervention effects: an immediate effect and a prolonged effect. An immediate effect was defined as the effect measured immediately after the intervention. A prolonged effect was defined as the effect measured at a follow-up period after the completion of the last intervention session. If the investigation date was not specifically presented in the article, we assigned it as 2 years before publication.

Reviewing process

The first and second authors performed study selection and data extraction independently. In the first round, non-relevant literature was excluded by screening titles and abstracts; in the second round, the full-text analysis was performed. A final decision on the inclusion of articles was based on a full-text review. Results were compared, and differences were resolved by consensus or by the third

author. For individual RCTs, the risk of bias was evaluated using the Cochrane Collaboration's tool for assessing the risk of bias by two independent researchers (Higgins and Green 2011).

Data analysis

Data were synthesized across studies and presented narratively. We did not conduct the meta-analysis due to substantial heterogeneity in measures of disclosure as the intervention outcome, sampling method, and intervention components.

Results

Our initial database search yielded 2315 published citations; 89 additional citations were identified through other sources. After removing duplicates, 1455 citations remained. By screening titles and abstracts, 1324 records were removed. The full text of the remaining 132 articles was retrieved for further review. Of these 132 articles, 124 did not meet inclusion criteria. We found two intervention studies that were published by the same research team, who recruited the same MSM living with HIV as the study population and implemented two separate interventions to promote HIV disclosure to different targets, one to casual sex partners (Serovich et al. 2009) and the other to family members (Serovich et al. 2011). Since the current focus was HIV disclosure to sex partners, we excluded the latter study (Serovich et al. 2011) from the current analysis. Thus, eight studies ultimately met the criteria for inclusion in the final review (Fig. 1).

The included studies present a vast heterogeneity in general study characteristics (e.g., setting, sample size, sampling method, study design) and intervention characteristics (e.g., the theory used to inform the intervention, number of intervention sessions, method to deliver the intervention, follow-up period, and the disclosure measure to assess the intervention effect). In particular, the measure of the disclosure outcome varied in its dimension (behavior, attitude, or intention), disclosure recipient, time frame, and categories of potential responses.

Characteristics of eligible studies

The final sample consisted of eight studies published between 2005 and 2017, each of which evaluated an intervention designed to promote HIV disclosure to sex partners (Bachmann et al. 2013; Chiasson et al. 2009; Hirshfield et al. 2012; Lapinski et al. 2009; Milam et al. 2016; Serovich et al. 2009, 2017; Wolitski et al. 2005). The sample size of MSM living with HIV for these studies

ranged from 72 to 811. All of the eligible studies were conducted in the USA, and two of these eight studies recruited participants at the national level (Chiasson et al. 2009; Hirshfield et al. 2012). Unlike the other six intervention studies that targeted only men living with HIV, two studies recruited men both living with and without HIV (Chiasson et al. 2009; Hirshfield et al. 2012). The setting for sampling varied; two studies were clinic-based (Bachmann et al. 2013; Milam et al. 2016), two were website-based samples (Chiasson et al. 2009; Hirshfield et al. 2012), three studies used community-based sampling (Lapinski et al. 2009; Serovich et al. 2009; Wolitski et al. 2005), and one study adopted multiple approaches (Serovich et al. 2017) (Table 1).

The included studies represented different study designs: four studies (Hirshfield et al. 2012; Milam et al. 2016; Serovich et al. 2017; Wolitski et al. 2005) were RCTs, one study (Lapinski et al. 2009) used a pre-test/post-test quasi-experimental design, two (Bachmann et al. 2013; Chiasson et al. 2009) used a longitudinal design without a control group, and one (Serovich et al. 2009) used a randomized control, crossover design. In the RCTs, the number of study arms varied from 2 to 5. Three (Milam et al. 2016; Serovich et al. 2017; Wolitski et al. 2005) of the RCTs were found to have a low risk of bias, while one (Hirshfield et al. 2012) has a potentially high risk of bias (Table 2).

Characteristics of included interventions

Intervention content

All studies applied health theories to inform the intervention design and implementation. The more commonly used theories to promote HIV disclosure to sexual partners were SCT (Chiasson et al. 2009; Lapinski et al. 2009; Milam et al. 2016; Wolitski et al. 2005), CT (Serovich et al. 2009, 2017), and TTM (Bachmann et al. 2013; Milam et al. 2016); other tested theories included theory of reasoned action (TRA), the exercise of control, and information motivation behavioral skills model. In addition, the majority of the interventions were guided by more than one theory (Hirshfield et al. 2012; Lapinski et al. 2009; Milam et al. 2016; Wolitski et al. 2005) (Table 3).

Intervention content to promote HIV disclosure included components related to cognition [risk assessment, disclosure benefits and costs, self-efficacy for disclosure, and messages using social influence (modeling)], and components related to the implementation of disclosure (development of disclosure strategy, training on communication skills, rehearsal (role-playing), and management of negative reactions). Social support enhancement was covered

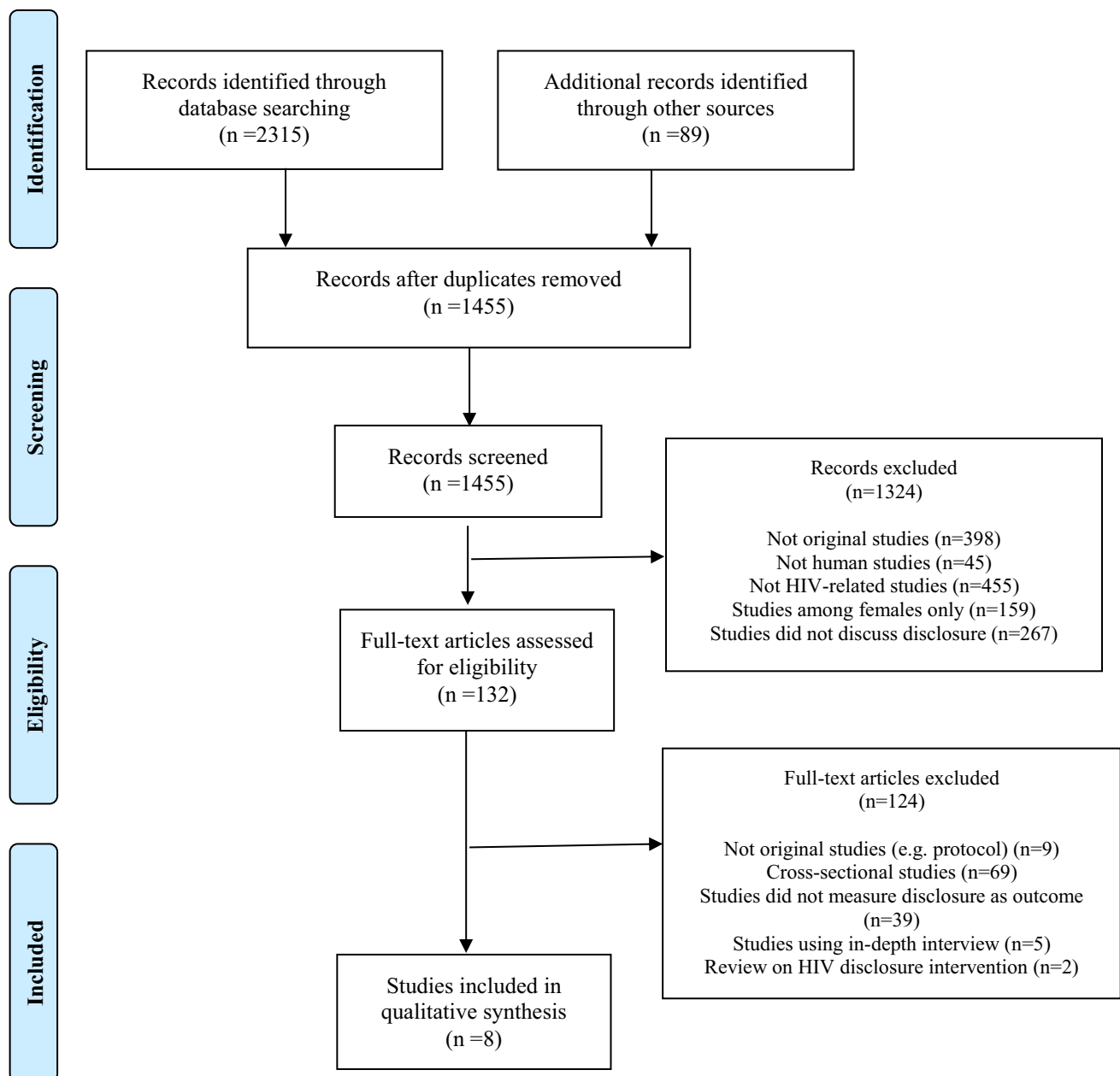


Fig. 1 Flow diagram of the study selection process according to preferred reporting items for systematic reviews (PRISMA)

by one study (Bachmann et al. 2013), but stigma reduction toward MSM living with HIV was not found.

Intervention format

Six (Bachmann et al. 2013; Lapinski et al. 2009; Milam et al. 2016; Serovich et al. 2009, 2017; Wolitski et al. 2005) out of eight studies delivered interventions using multiple sessions, ranging from 4 to 12 sessions, while two studies delivered a once-off intervention. Three interventions (Chiasson et al. 2009; Hirshfield et al. 2012; Milam et al. 2016) were delivered via the internet, two (Lapinski et al.

2009; Wolitski et al. 2005) through peers living with HIV, one (Bachmann et al. 2013) via health providers, and two (Serovich et al. 2009, 2017) via program facilitators. Five interventions (Bachmann et al. 2013; Chiasson et al. 2009; Hirshfield et al. 2012; Milam et al. 2016; Serovich et al. 2017) were delivered to each participant at the individual level, of which two (Bachmann et al. 2013; Milam et al. 2016) of them had tailored the intervention message according to each participant's prior response to questions asked via the website (Table 3).

Table 1 Characteristics of eligible studies

Study ID	Basic study information				Participants	
	First author, year	Years of the study	Place, country	Study design	Participants (N)	Sampling methods
1. Milam et al. (2016)	Joel Milam, 2016	2010–2012	Three Southern California sites, USA	1:1 two-armed RCT	181 MSM living with HIV	Clinic-based: recruited from patients engaged in ongoing clinical care in primary care HIV service
2. Bachmann et al. (2013) “Providers advocating for sexual health initiative”	Laura H. Bachmann, 2013	2004–2007	Birmingham, Alabama, USA	A longitudinal study with no control group	213 MSM living with HIV	Clinic-based: recruited from patients receiving primary care at a university-based HIV clinic
3. Hirshfield et al. (2012)	Sabina Hirshfield, 2012	2008	USA: Nationwide	1:1 five-armed RCT	3092 MSM, including 532 MSM living with HIV	Website-based: recruited from four gay-oriented sexual networking websites
4. Serovich et al. (2009)	Julianne M. Serovich, 2009	2007	A large Midwestern city, USA	A randomized control, crossover design (three-armed)	77 HIV-positive adult MSM	NGO- and community-based
5. Chiasson et al. (2009)	Mary Ann Chiasson, 2009	2005	USA: Nationwide	A longitudinal study	442 MSM (not specified HIV status)	Website-based: the largest gay subscription-based sexual meeting websites
6. Lapinski et al. (2009) “Prevention options for positives”	Maria Knight Lapinski, 2009	2007	Michigan, USA	A pre-test–post-test quasi-experimental design	72 MSM living with HIV (including 11 bisexuals)	Community-based
7. Wolitski et al. (2005) “Seropositive urban men’s intervention trial”	Richard J. Wolitski, 2005	2000–2002	New York City and San Francisco, USA	RCT	811 HIV-positive gay and bisexual men	Community-based
8. Serovich et al. (2017)	Serovich et al. (2017)	2009–2014	2 US metropolitan areas in the Midwest and Southeast	RCT	337 MSM living with HIV (including 69 bisexuals)	Multiple channels (local newspaper advertisements, local and state AIDS service organizations, AIDS clinical trials units, forums, and other venues)

Intervention effect

Table 4 presents detailed results by study. Assessment of an intervention effect varied across different studies. Three studies (Lapinski et al. 2009; Serovich et al. 2009, 2017) evaluated both the immediate effect and the prolonged effect, two (Bachmann et al. 2013; Milam et al. 2016) evaluated the immediate effect only, and three (Chiasson et al. 2009; Hirshfield et al. 2012; Wolitski et al. 2005) evaluated the prolonged effect only. For the immediate effect of the intervention, three (Lapinski et al. 2009;

Milam et al. 2016; Serovich et al. 2009) out of five evaluated interventions were effective in promoting HIV disclosure to sex partners while two (Bachmann et al. 2013; Serovich et al. 2017) interventions were not. Effective interventions were a 12-session internet-delivered intervention, a 4-session facilitator-delivered intervention, and a 9-session peer-delivered intervention. For the prolonged effect of the intervention (follow-up for 6 weeks to 6 months), three (Chiasson et al. 2009; Hirshfield et al. 2012; Serovich et al. 2009) out of six evaluated interventions were effective in promoting HIV disclosure to sex

Table 2 Summary of risk of bias of included randomized controlled trial studies

Study ID	First author, year	Sequence generation	Allocation concealment	Blinding	Incomplete outcome data	Selective outcome reporting	Other bias ^a	Summary of risk of bias
1. Milam et al. (2016)	Joel Milam, 2016	+	+	—	? ^b	+	+	Low risk
2. Hirshfield et al. (2012)	Sabina Hirshfield, 2012	+	+	—	— ^c	+	— ^d	High risk
3. Wolitski et al. (2005)	Richard J. Wolitski, 2005	+	+	—	+	+	+	Low risk
4. Serovich et al. (2017)	Julianne M. Serovich, 2017	+	+	—	+	+	+	Low risk

Categories of risk: low risk (+); unclear risk (?); high risk (—)

^aOther bias: possible intervention contamination, recruitment bias, and data collection bias

^bLost to follow-up rate was between 20 and 25%. The author reported that there was no difference in the number of study completers by arm of the study and no difference in the time to premature discontinuation

^cAlmost half of the participants in each group were lost to follow-up for the evaluation survey. In addition, the author reported that there were statistically significant differences (in age, race, income, having non-main partners, and the number of lifetime sex partners) between MSM who completed 60-day follow-up and those who were not

^dRecruitment bias might exist, as two recruitment methods were applied but MSM living with HIV were significantly more likely to have been recruited through a banner ad than by email

partners while the other three (Lapinski et al. 2009; Serovich et al. 2017; Wolitski et al. 2005) interventions were not. Effective interventions included a single-session internet-delivered intervention, a 4-session facilitator-delivered intervention, and a single-session internet-delivered intervention (Table 4).

Table 5 presents a summary of the finding. All eight included studies measured HIV disclosure behavior as the outcome variable, one of the eight studies measured HIV disclosure attitude and intention (Serovich et al. 2009), and one of the eight studies measured subjective norms related to HIV disclosure (Lapinski et al. 2009). Three out of six studies measuring an overall degree of disclosure behavior reported an increased proportion of disclosure to sex partners through interventions. Two out of three studies measuring disclosure with the last partner reported an increased rate of disclosure to the last partner through interventions. The majority of studies using “asking,” “telling,” and “asking and telling” as disclosure measures found a significant intervention effect.

Ethical concerns of the intervention

Two studies applied the CT to the intervention design and implementation; therefore, the risk of disclosure, along with its benefits, was discussed with the participants (Serovich et al. 2009, 2017). Two studies mentioned that appropriate referrals to psychological and supportive services were made available to participants (Lapinski et al.

2009; Wolitski et al. 2005). Therefore, we believe that participants could get continued support in case of negative responses happen after disclosure (e.g., threat, violence). However, no study mentioned that the disclosure decision (including non-disclosure) should be made exclusively and voluntarily by the participants even when they were assigned to the intervention group that aimed to increase disclosure. No study reported a provision of stigma reduction as a component of the given intervention despite the participant’s stigmatized identity (both MSM and living with HIV).

Two studies reported community engagement in the research; forms of such engagement included a formulation of the community advisory boards, participants’ recruitment through community-based organizations, community’s involvement in the intervention design, and delivery of the intervention by community facilitators (Lapinski et al. 2009; Wolitski et al. 2005). One study reported that the small group discussion, as an intervention strategy, created negative role models as some participants disclosed that they regularly had unprotected sex and that they were not convinced that receptive anal or insertive oral sex could transmit HIV (Wolitski et al. 2005). No study reported cases of bullying when conducting group-based interventions.

Table 3 Characteristics of included interventions

Study ID	N	Number of sessions and frequency	Who delivers the intervention	Format	Tailored intervention content or not	If intervention guided by theory
1. Milam et al. (2016)	90	Once per month for 12 months	Internet-delivered	Individual level	Tailored message to participants based on their responses to an electronic data management system	(1) SCT and (2) The TTM of Change
2. Bachmann et al. (2013) “Providers advocating for sexual health initiative”	213	5 times for each HIV primary care clinic visit	Provider-delivered	Individual level	Tailored message to participants based on their responses to an audio computer-assisted self-interview system	The TTM of change
3. Hirshfield et al. (2012)	609–633 in each intervention group	Once	Internet-delivered	Individual level	Same intervention (not tailored) for all participants in the same group	Social learning theories
4. Serovich et al. (2009)	40 completed the facilitator-only treatment, and 37 completed the computer and facilitator treatment	4 sessions	Facilitator-delivered (with/without paper-and-pencil exercises electronically)	Group level	Same intervention (not tailored) for all participants in the same group	CT
5. Chiasson et al. (2009)	422	Once	Internet-delivered: an online 9-min video drama named “The Morning After”	Individual level	Same intervention (not tailored) for all participants	Developmental, social, and cognitive-constructivist learning theories, including SCT
6. Lapinski et al. (2009) “Prevention options for positives”	24	3 individual counseling (45 min each) + 6 group sessions (once the other week, 1.5 h)	Peer-facilitated group session; counselor-facilitated individual counseling	Individual counseling (ILC) + group session (GLS)	Both	(1) SCT (2) TRA
7. Wolitski et al. (2005) “Seropositive urban men’s intervention trail”	413	6 sessions (one night per week, for a total of 6 weeks), and each session lasted 3 h	HIV-positive peer-delivered	Group level	Same intervention (not tailored) for all participants	(1) SCT (2) The exercise of control (3) Information motivation behavioral skills model of AIDS risk behavior change (4) TPB
8. Serovich et al. (2017)	172	4 sessions and each session lasted 60–90 min	Trained facilitators	Individual level	Not specified	CT

CT Consequence theory, SCT social cognitive theory, TTM trans-theoretical model, TRA theory of reasoned action, TPB theory of planned behavior

Table 4 Summary of the outcome measures and intervention effects

Study ID	Outcome variable			Intervention immediate effect (immediate after intervention)	Intervention prolonged effect (follow-up a period after intervention)
	Measures of disclosure (dimension)	Disclosure recipient	Time frame	Response	
1. Milam et al. (2016)	HIV disclosure behavior	HIV-negative/ unknown status partners	In the past month	All disclosed disclosed	N.A. (not assessed)
2. Bachmann et al. (2013) “Providers advocating for sexual health initiative”	HIV disclosure behavior	HIV-positive partners HIV-negative partners HIV unknown partner	–	All disclosed disclosed	N.A. (not assessed)
	HIV disclosure behavior Ask Tell Ask and tell	The last partner	In the past two months	Yes versus no	
3. Hirshfield et al. (2012)	HIV disclosure behavior Ask Tell Ask and tell	The last partner	In the past two months	Yes versus no	

Table 4 (continued)

Study ID	Outcome variable		Time frame	Response	Intervention immediate effect (immediate after intervention)	Intervention prolonged effect (follow-up a period after intervention)
	Measures of disclosure (dimension)	Disclosure recipient				
4. Serovich et al. (2009)	HIV disclosure behaviors (13-item scale) HIV disclosure attitudes (13-item scale) HIV disclosure intentions (13-item scale)	–	–	HIV disclosure behaviors: none, a few, about half, most, and all HIV disclosure attitudes and intention: 5-point Likert-type responses from “strongly disagree” to “strongly agree”	Facilitator-only condition versus control (3 months post-intervention) Scores on the intention scale were lower (1.82 versus 2.69; $p < 0.05$)	Facilitator-only condition versus control (3 months post-intervention) Scores on all three scales were lower (2.11 versus 2.83 for behavior; 1.78 versus 2.35 for attitude; 1.95 versus 2.53 for intention) Effect sizes were medium to large for a reduction in behavior scores (0.69), moderate for attitude scores (0.44) and small for intention scores (0.25)
5. Chiasson et al. (2009)	An overall disclosure behavior in a three-month period HIV disclosure behavior with their last partner	All partners The last partner	In the past three months In the last encounter	Yes (always, usually) versus no (sometimes, rarely, never) Yes versus no	Computer and facilitator intervention versus control No differences were found in any disclosure scales N.A. (not assessed)	Computer and facilitator intervention versus control (3 months post-intervention) No differences were found in any disclosure scales (3-month follow-up) Men were significantly more likely in general to ask (OR 2.79), tell (2.10), and “ask and tell” (3.37) in a three-month period; all $ps < 0.05$ No significant changes were found for HIV disclosure to the last partner, including ask, tell, and “ask and tell”
6. Lapinski et al. (2009) “Prevention options for positives”	HIV disclosure behaviors (ask or tell) Subjective norms regarding HIV disclosure	The last partner (main partner or other partners) Friends, family, and PLWH community members	In the last encounter	Yes, no, do not know 5-point Likert-type scale indicating the level of endorsement of the belief	Group-level session/individual-level counseling group were more likely to tell and ask with their main partner than the individual-level counseling group No differences were found for the disclosure behavior with partners other than the main partner No differences were found for the disclosure-related subjective norms	(6-week follow-up) No differences were found for the disclosure behavior with any partners No differences were found for the disclosure-related subjective norms
7. Wolitski et al. (2005) “Seropositive urban men’s intervention trial”	HIV disclosure behavior before (and since) the first sexual encounter	Main partner Non-main partner (HIV-positive, HIV-negative, and unknown)	In the past 90 days	Yes versus no All, some or none	N.A. (not assessed)	(3-month and 6-month follow-up) No differences were found for the proportion of sex partners who were disclosed to
8. Serovich et al. (2017)	HIV disclosure behavior (13-item measure)	Casual sex partners with different HIV status	In the past month	All, the majority, half, some, none of my sexual partners	No intervention effect was observed	(6-month and 12-month follow-up) No intervention effect was observed

Table 5 Synthesis of the results

Disclosure-related outcomes	Number of studies that		
	Measured it	Improved by the intervention (immediate or prolonged effect)	Failed to be improved by the intervention
HIV disclosure behavior (any of the behaviors below)	8	5	3
An overall degree of disclosure behavior	6	3	3
Disclosure with the last partner	3	2	1
Disclosure with main partner	3	1	2
Disclosure with non-main partner	4	1	3
Ask the partner about the HIV status	3	3	0
Tell the partner about the HIV status	3	2	1
Ask and tell	2	2	0
Disclosure with HIV-positive partner	3	0	3
Disclosure with HIV-negative partner	4	1	3
Disclosure with HIV unknown partner	4	1	3
Disclosure before the first sexual encounter	1	0	1
Disclosure since the first sexual encounter	1	0	1
HIV disclosure attitude	1	1	0
HIV disclosure intention	1	1	0
HIV disclosure-related subjective norms	1	1	0

Discussion

This was the first systematic review, specifically among MSM living with HIV, aimed to identify effective intervention components in promoting HIV-positive status disclosure. We found that interventions that used CT, SCT, and TTM and included more core components were more likely to achieve the expected intervention effect in promoting HIV disclosure. These core components included risk assessments, disclosure outcome expectancy, development of disclosure strategy, and delivery of the message using social influence.

This review found that intervention components based on CT were helpful to promote HIV disclosure. Serovich et al. conducted a pilot RCT among 77 MSM living with HIV and developed an intervention focusing on the costs and benefits of disclosure. They found that the intervention was effective in promoting HIV disclosure behavior and positive attitude (Serovich et al. 2009). Altering disclosure-related outcome expectancy (both costs and benefits), as the key message in CT, is in line with the human nature, as individuals avoid costly relationships, interactions and seek rewarding ones to maximize the profits through their behaviors (Emerson 1976).

We found that interventions covering messages under the social influence (e.g., observational learning), a key construct in SCT, were effective in altering participants' disclosure behaviors. For example, Lapinski et al. designed a peer-delivered group intervention that participants

worked through an exercise that allowed for observational learning in applying methods of HIV disclosure. This study found that participants who were exposed to such learning process were more likely to ask and tell their main partner about HIV status at the post-intervention (Lapinski et al. 2009). MSM peers incline to have the advantage in producing such effect related to social influence due to the similar experience, shared cultural background, and interactions with the common underground value in the community (LeBeau and Jellison 2009). Therefore, interventions delivered by MSM peers are more likely to gain such a benefit.

This review found that intervention components following TTM were helpful to promote HIV disclosure. It is not a simple linear process for making a disclosure decision or implementing the disclosure behavior. TTM divides behavior changes to phases of pre-contemplation, contemplation, preparation, action, maintenance, and termination (Prochaska 2013), and a specific intervention exerts a maximum effect on individuals who are in a matching disclosure phase but less so if the individuals are in another phase.

This review found that all interventions delivered via the internet appeared to be effective in promoting HIV disclosure to sex partners among MSM. This finding is consistent with a previous review on the reduction of risk behaviors, which found that internet-delivered interventions could affect a wide range of behaviors among MSM, including uptake of HIV testing, unprotected anal

intercourse, and methamphetamine use (Schnall et al. 2014). Internet-delivered interventions have the advantage of wide coverage also to hard-to-reach key populations, low cost, and potential interactions between users and providers (Griffiths et al. 2006). These features may be particularly important for MSM living with HIV who face the stigma of being HIV-positive and the stigma of belonging to a sexual minority (Alonzo and Reynolds 1995; Lee et al. 2002; Rowen and Malcolm 2003). Receiving interventions through the internet does not require them to meet others, in turn, protect them from discriminatory attitudes or confidentiality breach.

This review found that both multiple sessions-based interventions and one single-session-based intervention appeared effective in terms of promoting disclosure among MSM. A single-session-based intervention might be enough to provide knowledge and provoke contemplation regarding benefits and costs related to disclosure [the key point in making a disclosure decision (Serovich 2001; Serovich et al. 2008)]. More components covered in multiple sessions, such as skills training and rehearsal, could be completed by MSM themselves. Single-session interventions have the advantages of causing a minimal burden for both the patient and the provider. A greater number of intervention sessions among MSM is, however, preferred in terms of the effect outcome when resources allow, and appropriate retention in the intervention program can be ensured.

Disclosure interventions should aim to produce both immediate and prolonged effect in improving disclosure behaviors among MSM. HIV disclosure decision is more likely to be a deliberate decision than an impulsive one. The disclosure decision-making process involves a careful and serious weighing of rewards and costs, which might make disclosure behavior changes after a period since the completion of interventions. Moreover, some MSM might need time to rehearse disclosure-related new skills before implementing them (Serovich et al. 2009). Such speculation indicated a need to add booster maintenance sessions to increase the potency of the intervention (Whisman 1990).

Compared to two published reviews related to HIV disclosure interventions (Conserve et al. 2015; Kennedy et al. 2015), the current review adds new knowledge to the literature from two aspects. This review particularly targets MSM living with HIV, who is the key population in the HIV epidemic. Direct evidence based on this review would benefit MSM living with HIV the most. Moreover, this review has a focus on analyzing HIV disclosure interventions from the perspective of behavioral theories, and future interventions based on the reported well-known theory are the most likely to succeed.

We identified four knowledge gaps in the current review, and more rigorous HIV serostatus disclosure-related intervention trials are needed. First, the fact that only eight interventions were included and all of them were conducted in the USA indicates an urgent need to implement and evaluate more disclosure-related interventions especially in regions with high HIV prevalence among MSM (e.g., Sub-Saharan Africa and The Caribbean). Second, some studies in the current review assessed the intervention's immediate effect only or prolonged effect only, which limited our understanding about when and how the intervention worked in changing disclosure behaviors. Third, some studies included in the current review did not report (or address) significant ethical concerns during the intervention design and implementation related to disclosure (e.g., an emphasis on voluntary disclosure). Last, the disclosure outcomes (e.g., dimension, recipient, time frame) measured in the present review were not comparable; thus, no conclusion can be made about what type of interventions is more likely to succeed than others in promoting disclosure. These measures should be standardized and personalized in the context. When to consider an overall degree of disclosure behavior as the indicator of intervention effect, the disclosure recipient (e.g., casual sex partners) and the recall period (e.g., in the past three months) should be standardized to make comparisons meaningful. However, disclosure measures should be personalized when interventions have different purposes: One intervention that aims to improve partner support through disclosure should focus on main partners, while the other intervention that aims to reduce unsafe sex through disclosure should focus on non-main partners.

Conclusions from this review must be considered in light of the limitations of the existing evidence. First, as all data were derived from MSM living with HIV in the USA, the findings might be not generalizable to MSM living with HIV in other countries. Second, researchers should be careful when to infer similarities and differences in disclosure outcomes between studies that are in different formats. Third, as studies included showed heterogeneity in disclosure measure as the outcome, we were unable to estimate an overall quantitative effect of the intervention through meta-analysis.

To prevent HIV transmission, there continues to be a pressing need for interventions that support MSM through the process of disclosing HIV serostatus to their sexual partners. However, it is also essential to understand their circumstance, offer them choices they have (including non-disclosure choice), and support voluntary disclosure decisions exclusively made by the MSM. If a non-disclosure decision is made, advice on safe sex and counseling on treatment adherence should be made available to the MSM. If a disclosure decision is made, in addition to assisting the

disclosure process, researchers and interventionists should continuously monitor disclosure-related negative consequences or risks and provide them support and services whenever needed.

Conclusion

Future interventions aimed to promote HIV disclosure to sex partners among MSM living with HIV are more likely to succeed if they apply theories that have been tested effective (e.g., CT, SCT, TTM) and include multiple components in interventions (e.g., risk assessment, disclosure outcome expectancy, disclosure strategy, and modeling).

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflicts of interest.

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