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REVIEW

Systematic review of HIV prevention interventions in China: a health communication perspective

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Abstract
Objectives To examine whether communication strategies and principles have been utilized in the HIV prevention intervention programs conducted in China.
Methods Comprehensive literature searches were conducted using *PsycINFO*, *Medline*, *and Academic Search Complete* with combinations of a number of keywords. Studies were included if they (1) were conducted in China and published prior to October 2011; (2) tested interventions promoting HIV/sexual risk reduction; and (3) reported empirical outcome evaluations on HIV knowledge, condom use and other condom-related variables. Data on 11 dimensions were extracted and analyzed, including formative research, theory, message targeting, messenger and channels, process evaluation, evaluation design, outcome measures.
Results The majority of the 45 intervention studies were not theory-based, did not report conducting formative research or process evaluation, used pretest–posttest control group designs, combined nonmedia channels, printed and visual materials, and employed HIV knowledge and condom use as outcome measures.
Conclusions Many HIV prevention interventions in China have been successful in reducing HIV risk-related outcomes. This literature has its weaknesses; however, the current review illuminates gaps in the literature and points to important future directions for research.

Keywords HIV/AIDS · Prevention · Intervention · Systematic review · China

Introduction

In China, it is estimated that 740,000 people were living with HIV and 48,000 new cases occurred in 2009. In addition, there were 26,000 AIDS-related deaths in 2009, indicating HIV/AIDS is becoming the leading cause of death among infectious diseases (UNAIDS 2011).[1]

Although injection drug use and commercial plasma collection have been considered as the major routes of infection in China, sexual transmission is becoming a primary mode of HIV transmission, and one which bridges HIV infection to the general population (Hong and Li 2009). Among the estimated 740,000 people who are living with HIV in 2009, 44.3 % were infected by heterosexual transmission and 14.7 % by homosexual transmission. Among the 48,000 new cases in 2009, 42.2 % were contributed by heterosexual contact and 32.5 % by homosexual transmission (UNAIDS 2010).

Correspondingly, a number of prevention intervention programs have been conducted to reduce HIV-related

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[1] In the reference list, references marked with an asterisk were included in the systematic review.

risk-taking behaviors among diverse Chinese subgroups. Hong and Li (2009) systematically reviewed, summarized and compared the components of these intervention studies, including study location, sampling, research design, intervention strategies and outcomes, which brought a significant addition to our understanding of HIV prevention research efforts in China. The current study was also a systematic review of HIV prevention intervention studies conducted in China. However, the current review was quite distinct from Hong and Li's study from two aspects. First, the current review included studies that were published up until October 2011, which added about three more years of publications compared to Hong and Li's review (in that time, 25 studies were published in this area). Second, the current review examined interventions from a health communication perspective. That is we examined whether communication strategies and principles have been utilized in HIV prevention efforts. These principles include conducting formative research on the target audience, using theory to guide the development of the program, segmenting the target audience into homogenous subgroups, targeting messages, selecting appropriate channels and messengers, conducting process evaluation, and employing a sensitive outcome evaluation design. According to Noar (2006) and Peterson and DiClemente (2000), these communication principles and strategies should be applied when developing and implementing a campaign or intervention to increase chances of success. The extent to which interventions apply these principles can tell us something about the literature to date, and can potentially help pave the way for more effective interventions in the future.

Methods

Inclusion/exclusion criteria

Articles were included in this review if they (1) were published prior to October 2011; (2) were conducted in China; (3) examined any educational, psychosocial or behavioral interventions promoting HIV/sexual risk reduction; (4) reported an empirical outcome evaluation that assessed the impact of the campaign/intervention on at least one or more of the following HIV-related outcomes: HIV knowledge, condom use intentions, condom use attitudes and self-efficacy, condom use, HIV testing.

However, those focused on occupational prevention of bloodborne pathogens, antiretroviral treatment programs, sexually transmitted disease (STD) testing only or contraceptive only interventions were excluded. Also, since the focus of this review was on primary HIV prevention interventions, studies on the effects of interventions on HIV-infected target audiences were excluded. In addition, studies on mother-to-child transmission of HIV or on programs that provided care for children affected by HIV/AIDS were excluded. Finally, interventions targeting solely injection drug use practices or solely on reducing HIV-related stigma or improving attitudes toward people living with HIV and AIDS (PLWHA) were excluded.

Search strategy

Comprehensive literature searches were conducted through computerized databases, including *PsycINFO*, *Medline, and Academic Search Complete*. Combinations of the keywords HIV, AIDS, sexual behavior, intervention, campaign, HIV knowledge, safer sex, safer sexual behavior, HIV testing, China, were employed. In addition, the reference list of the review study conducted by Hong and Li (2009) was examined to exhaust potential intervention studies.

Data extraction and methodological quality

Two independent coders coded all the articles that met the inclusion criteria on 11 dimensions of interest, including location, intervention year, sample, target audience, formative research, theory, message targeting, messenger and channels, process evaluation, evaluation design and outcome measures. Methodological quality (MQ) for each study was also coded on 12 items derived from Miller and Wilbourne's (2002) methodological quality rating scale (MQRS) and Kennedy et al.'s study (2010). Sample items include "prospective cohort," "random assignment of participants to the intervention," "follow-up rate of 80 % or more," "control/comparison groups equivalent on sociodemographic measures," "control/comparison groups equivalent at baseline on outcome measures," "outcome data collected by personnel blind to treatment condition." One point was awarded for each of these 12 items. Holsti's (Budd et al. 1967) formula was used for calculating intercoder reliability for each of the ten dimensions. The intercoder reliability ranged from 0.70 to 1.0. The two coders discussed disagreements with the first author and arrived at agreement on all discrepancies.

Results

Figure 1 is a flow diagram reflecting the study selection process and the reasons for excluding studies. Initial searches resulted in 242 abstracts that were examined more closely for potential relevance to this review. A total of 70 articles that had the potential to be included in the review were accessed in full text and examined. Given our inclusion criteria, a number of articles were excluded,

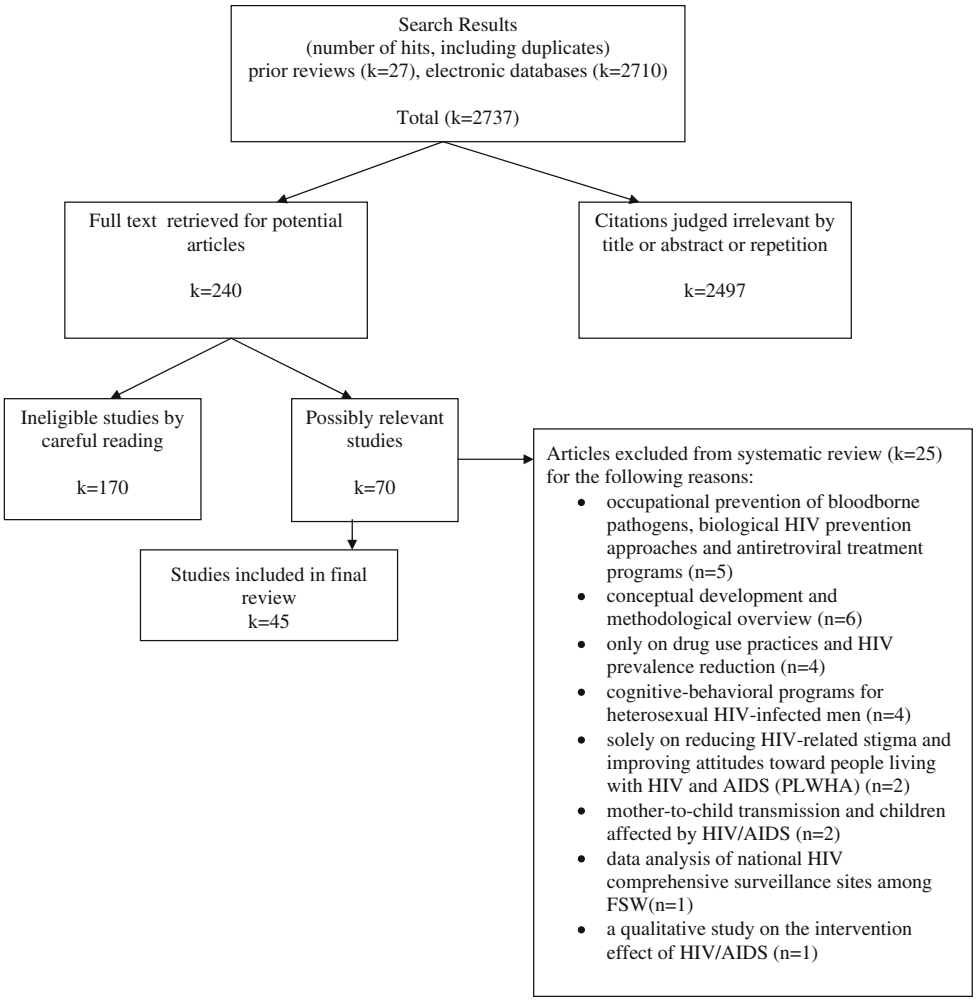

Fig. 1 Flow diagram of study selection for the systematic review

including five studies (7.1 %) that focused on occupational prevention of bloodborne pathogens, biological HIV prevention approaches and antiretroviral treatment programs; six studies (8.6 %) that focused on conceptual development and methodological overview rather than on outcome evaluations of HIV interventions; four studies (5.6 %) that focused only on drug use practices and HIV prevalence reduction; four studies (5.6 %) that focused on a cognitive-behavioral program for heterosexual HIV-infected men; two studies (2.9 %) that focused solely on reducing HIV-related stigma and improving attitudes toward people living with HIV and AIDS (PLWHA); two studies (2.9 %) that focused on mother-to-child transmission or programs that provided care for children affected by HIV/AIDS; one qualitative study (1.4 %) on the intervention effect and one data analysis study (1.4 %) of national HIV comprehensive surveillance sites.

Therefore, a total of 45 articles were included in the final data set for review. The current review found that most of the intervention studies were conducted after the year of 2000 and at some common locations such as Shanghai ($k = 8$), Sichuan ($k = 7$ studies), Guangxi ($k = 6$), and Anhui ($k = 6$). Some studies were conducted in more than one province (e.g., Rou et al. 2007; Williams et al. 2006). Table 1 presents characteristics of the intervention studies included in this review.

On average, studies received 6.3 out of 12 possible points for study design and methodological quality. Only three studies scored 10 or above points (out of 12 possible points). Fifteen studies scored 7–9 points and the rest were all rated lower than 7 points. Methodological quality scores for each study are shown in Table 2. Table 2 also presents the use of communication principles by the studies reviewed in the current study. These are now each discussed in turn.

Formative research

In the current review, only 16 (35.6 %) intervention studies reported conducting any formative research activities. The methods that have been employed in conducting formative research in this literature include pilot testing, focus

Table 1 Characteristics of HIV intervention studies conducted in China through October 2011

Study	Location	Intervention year	Sample (*N*)	Target audience
Cai et al. (2008)	Shanghai	2004–2006	1,950	Senior high school students
Chen and Liao (2005)	Guangxi	2002	100	Female IDUs
Cheng et al. (2008)	Henan	2003	1,174	Senior high school students
Feng et al. (2009)	Chongqing	2006–2007	1,772	MSM
Gao and Wang (2007)	Sichuan	2005	160	Gays, money boy-commercial sex workers
Hammett et al. (2006)	Guangxi	2002–2004	291	IDUs
Huang et al. (2008)	Fujian	2006	3,068	Senior high school students
Jiang et al. (2010)	Fujian, Xinjiang, Guangxi, Shanxi	1999–2009	362 for project counties 373 for non-project counties	General population
Lau et al. (2007)	Sichuan	2003–2005	400	Establishment-based and street-based FSW
Lau et al. (2008a)	Hong Kong		140	MSM
Lau et al. (2008b)	Sichuan	2002–2004	1,832	IDUs
Lau et al. (2009)	Sichuan	2005–2006	356	Male clients of FSW
Lau et al. (2010)	Hong Kong	January 2005–March 2006	301	Male Cross-border truck drivers
Li et al. (2010)	Shanghai	March–June of 2006	2,237 boys and girls	Children of migrant workers
Li et al. (2008)	Nanjing, Jiangsu Province	2001	186 for intervention, 194 for control group	College students
Li et al. (2006)	Nanning, Guangxi Province	2004	400	FSW
Li et al. (2011)	Nanjing		156 for control group 131 for intervention group	High school students
Liao et al. (2006)	Hainan	January–July 1997 January 1999–January 2001	221	FSW
Liao et al. (2010)	Hainan	2006–2008	1,720 baseline and 1,437 mid-term for intervention group 693 at baseline and 5,383 at mid-term for control group	Rural students of primary schools
Liao et al. (2011a, b)	Two rural towns in Hainan Province and one small city in Guangxi Province	2008–2009	75 for the first intervention site, $N = 75$ for the second intervention site, 150 for the third site	FSW
Liao et al. (2011a, b)	Hainan Province	2008–2009	152 baseline 112 at 6-month survey 111 at 12-month survey	FSW
Lin et al. (2010)	Beijing		200 intervention 100 control group	Female migrants
Lou et al. (2006)	Shanghai	March 2003–December 2003	624 for intervention 713 for control group	High school and college students
Ma et al. (2002)	Guangzhou	March 1998–October 1999	966	FSW
NIMH Collaborative HIV/STD Prevention Trial Group (2010)	Fuzhou	2002–2007	1,130 for intervention 1,587 for control group	Vendor markets
Rotheram-Borus et al. (2011)	A large eastern coastal city	2002–2006	1,979 for intervention 1,933 for control	Migrant food market vendors
Rou et al. (2007)	Anhui Province, Beijing, Fuzhou, Guangxi, Xinjiang	February 2000–November 2001	907	Entertainment establishments-based FSW
Shen et al. (2008)	Shanghai		1,910	Senior high school students
Tian et al. (2007)	Yunnan	January 2003–January 2004	Villagers: 1,368 Students: 1,368	Villagers and students in rural counties

Table 1 continued

Study	Location	Intervention year	Sample (*N*)	Target audience
Wang and Keats (2005)	Sichuan		450	Male participants in Yi, Tibetan and Han cultural groups
Wang et al. (2005)	Suburban Shanghai	May 2000–January 2002	2,227	Unmarried youth aged 15–24
Wang et al. (2006)	Suburban Shanghai	May 2000–January 2002	2,227	Unmarried youth aged 15–24
Wang et al. (2009)	Anhui		Physicians: 69 Patients: 242	Physicians at country-level hospitals
Williams et al. (2006)	Yunnan, Xinjian, Sichuan, Guandong, Guangxi, Anhui, Heilongjiang	Between January and December 2003	208	Nurses
Wu et al. (2002)	Anhui	1997–1999	296	Both health workers and villagers
Wu et al. (2007a)	Yunnan	March 1997–October 1997	313	Establishment owners and FSW
Wu et al. (2007b)	Guangdong Guangxi	2002–2003	823	IDUs
Wu et al. (2010)	Yunnan	January 2006–January 2007	645 for women group 678 for Buddhist group	Dai farmers
Yang et al. (2005)	Jiangsu	2001	355 for baseline 268 for midterm 311 for followup	FSW
Ye et al. (2009)	Fujian	2006–2008	981 for intervention group, 2,087 for control group	Senior high school students
Zeng et al. (2009)	18 cities in Heilong Jiang, Jilin, Liaoning, Neimenggu, Ningxia, Gansu, Chongqing	2006–2008	5,460	MSM
Zhang et al. (2010)	Anhui	May to October 2006	218	MSM
Zhao et al. (2005)	Shanghai	2003–2004	101	IDUs
Zhou et al. (2009)	Sichuan	2002–2005	2,066	IDUs
Zhu et al. (2008)	Anhui		218	MSM

IDUs injection drug users, *FSW* female sex workers, *MSM* men who have sex with men

groups, in-depth case studies or interviews, special workshops, and group discussions. The remainder of the intervention studies did not report any formative research activities.

Use of theory

In the current review, only 15 (33.3 %) studies reported using theory (e.g., Hammett et al. 2006; Gao and Wang 2007; Li et al. 2008), while the remainder did not mention theory at all. Most of the studies that used theories were based on behavior change theories, but none of the studies reported using information processing or message effects theories to direct message design. Some of the theories and models reported included the health belief model, social cognitive theory, diffusion model, the behavioral-ecological model, protection motivation theory, AIDS risk reduction model, subcultural model, leadership-focused model, communication model, empowerment model, sociopolitical model, social structural model, social action model, and cultural approach. One study (i.e., Chen and Liao 2005) reported that the intervention combined Chinese ethics and Western intervention theories, but did not mention which Western theory was employed.

Segmentation of audience

All of the 45 studies reported that the corresponding interventions targeted a specific audience of interest. The main segmented audiences included injection drug users ($k = 6$, e.g., Chen and Liao 2005; Hammett et al. 2006; Lau et al. 2008b; Wu et al. 2007b; Zhao et al. 2005; Zhou et al. 2009) and establishment-based and street-based female sex workers ($k = 9$, e.g., Lau et al. 2007; Li et al. 2006; Liao et al. 2006; Ma et al. 2002; Rou et al. 2007; Yang et al. 2005). However, this study found senior high school students ($k = 8$, e.g., Cai et al. 2008; Cheng et al. 2008; Huang et al. 2008; Shen et al. 2008; Ye et al. 2009) and men who have sex with men/gays/money boys ($k = 6$, e.g., Gao and Wang 2007; Lau et al. 2008a; Zhang et al. 2010; Zhu et al. 2008) were also becoming main target audience. Other target populations included establishment

Table 2 Communication strategies and outcomes of HIV intervention studies conducted in China through October 2011

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Cai et al. (2008)	None	None	None	Peer-led school-based intervention	Pretest–posttest Control design	HIV knowledge***; Intention to use condoms***	10
Chen and Liao (2005)	Pilot-testing NGO–BRIM	NGO-based relational intervention model (NGO–BRIM)	Interviews with prevention workers and focus groups with participants	Face-to-face educational sessions	Pretest–posttest one group design	HIV knowledge** Intensity of condom use** Unsafe drug use**	5
Cheng et al. (2008)	None	None	None	HIV/AIDS education through life-planning skills training program Participatory training methods (group discussion, role playing, brain storm, case study, games, etc.) were used	Pretest–posttest control group	HIV/AIDS knowledge**** Attitude toward PLWHA**** Self-efficacy**** Communications on HIV/AIDS****	6
Feng et al. (2009)	None	None	None	Peer-led and researcher-led education Condom distribution and HIV consulting and testing	Pretest–posttest one group	HIV knowledge** Last time condom use during anal sex** Last 6 months condom use during anal sex**	5
Gao and Wang 2007	Case studies, focus groups, special workshops	HBM, SCT, TRA, diffusion model, subcultural model, leadership-focused model, communication model, empowerment model, socio-political model, social structural model, social action model, cultural approach	None	Gay bar-based participatory entertainment-education strategy and gay bar-based melodrama series on condom use were used Small media materials (e.g., logo, coaster, making-friend card) were provided Outdoor entertainment games (e.g., sports, play cards and mahjong) were organized	Pretest–posttest Control group	Safe sex knowledge*** Attitudes toward HIV*** Condom use for vaginal sex with casual partners*** Condom use for anal sex with casual partners*** Condom use for vaginal sex with regular partners Condom use for anal sex with regular sexual partners***	5
Hammett et al. (2006)	None	The behavioral-ecological model (BEM)	None	4-year Peer-led community-based structural intervention	Pretest–posttest one group	HIV prevalence; gave money or drugs for sex in the past 6 months; Heterosexual sex in the past 6 months***; unprotected sex with casual partners in the past 6 months**; receptive sharing of needles in the past 6 months***; distributive sharing of needles in the past 6 months***	5
Huang et al. (2008)	None	None	80 % were involved in the intervention sessions	Peer-led and school-based One session per week for four weeks	Pretest–posttest control group	HIV/AIDS knowledge*** Attitude toward PLWHA*** Attitudes toward premarital/extramarital affairs**	6

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Jiang et al. (2010)	None	None	Rapid cross internal evaluation, mid-term external evaluation		Post test only control group design	HIV knowledge*** Condom use during the last intercourse*	3
Lau et al. (2007)	Pilot tests	None	None	China-UK project; Mobilization of community; Seminars and training programs; Publicity events and advertisements via different mass media; Outreach education by peer educators; VCT; Free STD checkup and support services; Social marketing of condoms	Pretest–posttest control group	HIV knowledge** Condom use**	7
Lau et al. (2008a)	None	None	None	Internet-based; periodic HIV-related information dissemination; Monitoring of behaviors with interactive feedback and online peer counseling	Pretest–posttest one group	Sex partnership Sexual behaviors Condom use Efficacy of the intervention was not supported	7
Lau et al. (2008b)	Pilot tests	None	None	Needle exchange programs; peer education; outreach intervention; condom distribution; VCT; seminars and support group for stakeholders	Pretest–posttest one group	Using other's used syringes in the last month* Condom use with commercial/nonregular partners*	5
Lau et al. (2009)	None	None	None	Peer education, workshops and seminars, printed educational materials	Pretest–posttest one group	Condom use in the last 6 months*** Condom use in the last episode*** Initiation of condoms use in the last episode*	6
Lau et al. (2010)	None	None	None	VCT plus information dissemination approach vs. the information dissemination only approach educational pamphlets	Pretest–posttest control group design	Consistent condom use with FSW* Consistent condom use with NRP** HIV/STD knowledge	9

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Li et al. (2010)	None	None	30 % of the intervention group completed the questionnaire for monitoring the implementation process; students received five times of training sessions and the median duration of interventions was 4 h; 90 % reported the sessions were useful	Peer-led school-based intervention group discussion, games, case study and brainstorming	Pretest–posttest control group	HIV knowledge** Attitude toward PLWHA** Protection self-efficacy**	9
Li et al. (2008)	None	Protection motivation theory	Five afternoons' intervention activities, about 2.5 h each afternoon	A cultural adaptation of the PMT-based "focus on kids" curriculum Trained graduate students and faculty members delivered the intervention curriculum to college students	Pretest–posttest control group	HIV/STD knowledge* Condom use knowledge***; HIV-related risk behaviors; HIV/STD related perceptions****; Self-efficacy****; Intention to engage in HIV-related risk behaviors*	7
Li et al. (2006)	25-min pretest VCT session	Theories of behavior change, particularly social cognitive theory and the theory of reasoned action	None	Adapting individual-oriented VCT intervention program that was developed and evaluated by the CDC's Project RESPECT. Client-centered, interactive approach. Discussion/questions, didactic messages, modeling and condom use skills practice, STD testing, distributing free condoms	Pretest–posttest control group	HIV/STD knowledge*** Consistent condom use* STD infection*	7
Li et al. (2011)	Qualitative and quantitative data gathering	Protection motivation theory	None	A cultural adaptation of the FOK HIV prevention program for high school students Graduate students and faculty members from a university in Nanjing delivered the adapted curriculum to intervention students in intervention classrooms 10 students in each group participated in games and role-play activities	Pre/post control group	HIV knowledge** Intentions to engage in sexual intercourse Self-efficacy to reject sex	7

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Liao et al. (2006)	Pilot intervention	None	47 % in 1999 and 62 % in 2000 reported familiarity with the WHC 55 % and 64 % reported having read educational materials in survey II and III	Outreach to sex workers through establishment of a local Women's Health Center Distribution of educational materials and condoms	Pretest–posttest one group	Consistent condom use in the last 6 months** Condom use last sex (first followup*, second and third followup**) HIV knowledge**	5
Liao et al. (2010)	None	None	None	An experimental curriculum was delivered by trained teachers to 5th graders. The curriculum included four lessons: adolescent development, HIV transmission and prevention, drug prevention, risk behavior rejection Participatory activities were used such as brain storming, role playing, group discussion, case study and games	Pre/post control group	HIV Knowledge*** HIV related attitudes	7
Liao et al. (2011a, b)	Formative community ethnography	None	Process evaluation (e.g., self-reported exposure to intervention and self-reported participation) was conducted	Local health workers outreach intervention to establishments. Activities included educational session, learning FC insertion with the vaginal model, practicing FC insertion, distributing FC, etc.	Pre/post design	Use of male condoms in the last 30 days; Use of female condoms in the last 30 days; 100 % protected sex in the last 30 days; Nil protection in the last 30 days	5
Liao et al. (2011a)	Formative community ethnography	None	Process evaluation was conducted, but no details	An educational session about FC, using an illustrated flip-chart; A demonstration of FC insertion using a plastic model vagina; female health practitioners from local hospitals conducted outreach	Three time-point cross-sectional surveys to assess community-wide change across establishments	Use of male condoms in the last 30 days; Use of female condoms in the last 30 days; 100 % protected sex in the last 30 days; Nil protection in the last 30 days	5
Lin et al. (2010)	None	Protection motivation theory	None	Games, group discussions, videos, rehearsals, role plays, brainstorming, homework assignments Psychology faculty members and graduate students in a local university delivered the intervention curriculum	Pre/post control group design	HIV knowledge*** Condom use self-efficacy*** Condom use response efficacy*** Intention to use condom*** Consistent condom use Correct condom use skills***	8

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Lou et al. (2006)	Focus group	None	Students' participation and feedback related to the intervention was evaluated considered	Messages on sexual and reproductive health knowledge, service information, counseling, and discussion were delivered through a special website that included web pages, online videos, Bulletin Board System and expert mailbox	Pre/post control group	Condom knowledge**** HIV/AIDS knowledge**** Attitudes toward sex-related issues Sex-related behaviors (e.g., kissing, hugging, sexual intercourse)	8
Ma et al. (2002)	None	None	None	Individual or group counseling was provided on reproductive health, STD/HIV transmission, and skills related to condom use by trained doctors or nurses Spoken information, written and video materials	Pretest–posttest cohort group	HIV knowledge*** Consistent condom use*** Self-efficacy***	5
NIMH Collaborative HIV/STD Prevention Trial Group (2010)	Preliminary ethnographic studies	Diffusion of innovation theory	Quality control procedures to ensure consistency and fidelity over time	Intervention and comparison conditions received HIV/STD prevention brochures and pamphlets, educational materials, information about HIV/STD counseling, testing and treatment But the Intervention condition received C-POL intervention and the community-level intervention C-POLs also wore logos on T-shirts, hats or other apparel	Pretest–posttest intervention and comparison groups design	Unprotected sex rate of STDs (including HIV)	11
Rotheram-Borus et al. (2011)	None	Diffusion of Innovation Theory	None	Community Popular Opinion Leader (C-PDL)-led intervention, Pilot C-PDL training and reunion sessions teaching skills in delivering and diffusing theory-based HIV/STI prevention messages to friends and acquaintances during everyday conversations	Pre/post control group	Unprotected extramarital sex among those who experienced one or more STIs at baseline	11

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Rou et al. (2007)	In-depth interviews, focus groups	None	None	VCDs, educational print materials and cartoon folders	Pretest–posttest one group	AIDS knowledge*** Sexual practice*** Condom use*** Incidence of STDs health seeking behaviors***	6
Shen et al. (2008)	None	None	One session every 2 weeks for 3 months 85 % were involved in the sessions	Peer-led school-based intervention sessions	Pretest–posttest control group,	HIV knowledge (key and ordinary schools**, vocational schools*); attitudes toward premarital/extramarital affairs (vocational schools**); attitudes toward PLWHA (key schools*, ordinary schools**)	7
Tian et al. 2007	None	None	None	Web-based intervention A total of 52 different programs on the website changed weekly	Pretest–posttest control group	HIV/AIDS knowledge**	5
Wang and Keats (2005)	In-depth case studies, focus groups, and special workshops, pilot testing	Behavior change theories in HIV (e.g., TRA, SCT, etc)	None	Workshops, group sessions, the oral role model stories strategy, and peer-led diffusion of role model stories	Pretest–posttest Control group	Knowledge about safe/unsafe sex*** Condom use with casual partners*** Condom use with regular partners***	5
Wang et al. (2005)	None	None	Intervention group reported receiving 8.7 brochures or books; 79 % viewed educational videos 25 % attended group discussions; 21 % attended the only lecture; Only 11 % utilized the counseling services	Community-based comprehensive sex education; distribution of brochures, pamphlets, books screening of educational videos; lectures, peer group discussions; provision of reproductive health services and counseling	Pretest–posttest control group	Coerced sex contraceptive use condom use	9
Wang et al. (2006)	None	None	Intervention group reported receiving 8.7 brochures or books; 79 % viewed educational videos; 25 % attended group discussions; 21 % attended the only lecture; only 11 % utilized the counseling services	Educational reading materials, videos, lectures Peer group discussions, provision of health services and counseling	Pretest–posttest control group	HIV/STD knowledge*** Sex-related knowledge*** Attitudes toward premarital sex (males*)	9

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Wang et al. (2009)	None	None	10-day workshop, one-week "booster" group training, and a final week-long group workshop	Workshops, didactic seminars, group discussions, role plays, case reviews, problem solving	Pretest–posttest one group	Physicians: HIV-related stigma and discrimination knowledge** Risk reduction counseling** Patients: HIV knowledge** Condom use Intention to use condoms Intention to reduce number of sex partners HIV testing plan**	4
Williams et al. (2006)	None	Bloom's Taxonomy and principles of good HIV/AIDS educational practice	5-day workshop	Didactic lectures and activities to elicit discussion of participants' values and personal feelings about HIV/AIDS Group discussion, role-play, seminars and games	Pretest–posttest one group	HIV/AIDS knowledge*** Attitudes toward patients with HIV/AIDS*** Willingness to provide nursing care***	5
Wu et al. (2002)	A pilot survey to provide information to which base the first workshop Pilot testing of educational materials	Diffusion of innovation	94 % participated in workshops and 92 % received training manuals	Health workers received initial workshops and then diffused programs through secondary and tertiary workshops at county and township levels to health workers and villagers Printed training manuals, flyers, newsletters, billboards, blackboards, radio, TV and loudspeakers were used to distribute intervention program. Role playing was conducted in counseling and videos were showed after discussions. Cases studies were used	Pretest–posttest control group design	HIV knowledge** Attitudes toward PLWHA** Condom use**	5
Wu et al. (2007a)	Face-to-face interviews with sex workers, focus group discussions with sex workers and establishment owners(separately)	None	51 % attended one session, 28 % two sessions, 13 % three sessions, 8 % at least four sessions.	Twelve trained and married female health workers led six face-to-face intervention sessions Establishment owners were also trained. Face-to-face lectures, questions and answers, video and audio tapes, print flyers or cartoon folders were used to deliver messages	Pretest–posttest one group	Condom use*** HIV knowledge*** Perceived HIV risk***	4

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Wu et al. (2007b)	In-depth interviews, group discussions and observations	None	60.8 % and 59.4 % of participants received educational pamphlets. 70.9 % and 69.6 % had seen educational posters,. 52.7 % and 55.2 % in Guangxi participated in a face-to-face counseling session with a health worker and a peer educator, respectively, and in Guangdong these figures were 61.7 and 66.0 %, respectively.	Intervention involved: handing out educational pamphlets, displaying educational posters, delivering lessons about drug abuse and HIV/ AIDS by health workers, viewing a photo exhibition and educational videos	Pretest–posttest control group	Needle sharing*** Condom use* Incidence of HCV and HIV	8
Wu et al. (2010)	None	No behavior change theory, but based on Participatory action research (PAR)	Questionnaire survey to pinpoint problems after each training session	Training sessions with health educators (voluntary monks and women). Training modes included lecturing, video shows, game-playing, panel discussion Monks then put up posters and distributed propaganda materials. Also they preached among worshipping villagers Women team included posters, propaganda materials, public speeches, song and dance performances, and true stories being incorporated into a popular local drama "Zanha"	Pretest–posttest comparison group design	Nonregular Partners: During the most recent sex**: never used condoms Consistently used condoms in the past 30 days** Attitudes toward PLWHA*	8
Yang et al. (2005)	None	None	Midterm evaluation	Government-led No specific information on the intervention program	Pretest–posttest one group design	Last time condom use with commercial partners** Last time condom use with non-commercial partners**	2
Ye et al. (2009)	None	None	None	None	Pretest–posttest control group	HIV/AIDS knowledge**; Attitudes toward PLWHA; condom use**	7
Zeng et al. (2009)	None	None	None	Peer education, distribution of education materials, hot lines, Internet, HIV consulting and testing	Pretest–posttest one group	HIV/AIDS knowledge** Last time condom use during anal sex::Last 6 months condom use** HIV testing***	4

Table 2 continued

Study	Formative research	Theory	Process evaluation	Message design/ messengers/channels	Outcome evaluation	Outcome	Methodology quality
Zhang et al. (2010)	None	AIDS risk reduction model	None	4 sessions of behavior labeling, commitment plan, taking action, dealing with barriers; role playing, games, group discussions, brainstorming, and competition to test knowledge	Pretest–posttest one group	HIV testing in the last 2 months*** Condom use***	5
Zhao et al. (2005)	None	None	None	PI-led group sessions and the HIV/AIDS prevention education manual; interpretation, demonstration through overhead, discussion, video taping, poster creation, role playing, practice, assignment	Pretest–posttest one group	HIV/AIDS knowledge**	6
Zhou et al. (2009)	None	None	≤30 % in 2003 but ≥80 % in 2005 received four services	Information, education and communication activities, peer education, VCT, condom distribution, needle-syringe program, methadone maintenance therapy, etc	Pretest–posttest control group	HIV Awareness increase* Needle sharing*** Condom use***	5
Zhu et al. (2008)	None	AIDS risk reduction model Diffusion of innovation theory Social network theory	None	Initiator-led and Peer referral train Role-play, graphics display, group discussion, games, case study, etc	Pretest–posttest one group design	HIV/STDs knowledge** The rate of female sexual partners** Condom use with casual partners in the last 3 episodes of anal sex* Condom use with regular partners in the last 3 episodes of anal sex**	6

C-POL community popular opinion leader, *PLWHA* people living with HIV/AIDS, *NRP* non-regular sex partners, *IDUs* injection drug users, *FSW* female sex workers, *FC* female condom, *MC* male condom, *VCT* voluntary counseling and testing

**** $P < 0.0001$, *** $P < 0.001$, ** $P < 0.01$, * $P < 0.05$

owners ($k = 1$, e.g., Wu et al. 2007a), female migrants ($k = 1$, e.g., Lin et al. 2010), male clients of female sex workers ($k = 1$, e.g., Lau et al. 2009), male cross-border truck drivers ($k = 1$, e.g., Lau et al. 2010), children of migrant workers ($k = 1$, e.g., Li et al. 2010), college students ($k = 2$, e.g., Li et al. 2008), Villagers and students ($k = 2$, e.g., Tian et al. 2007), males in different cultural groups ($k = 1$, e.g., Wang and Keats 2005), unmarried youth aged 15–24 ($k = 2$, e.g., Wang et al. 2005, 2006), physicians/nurses ($k = 2$, e.g., Williams et al. 2006), health workers and villagers ($k = 1$, e.g., Wu et al. 2002), general population ($k = 1$, e.g., Jiang et al. 2010), and rural students of primary schools ($k = 1$, e.g., Liao et al. 2010).

Message targeting

One study (Gao and Wang 2007) reported using a gay bar-based participatory entertainment education strategy (i.e., melodrama series on condom use), and five studies used oral role model story strategies (i.e., Wang and Keats 2005) or case study strategies (Cheng et al. 2008; Li et al. 2010; Wu et al. 2002; Zhu et al. 2008). In addition to their primary target audience, some studies employed the strategy to target the messages on interpersonal influencers such as establishment owners (Wu et al. 2007a), male clients of female sex workers (Lau et al. 2009), health workers/physicians/nurses (Williams et al. 2006; Wu et al. 2002).

Selection of messengers and channels

In the current review, only one study (e.g., Gao and Wang 2007) reported using logos to deliver relevant educational messages. Intervention studies used average persons (e.g., peers, graduate students) and professionals (e.g., faculty members, health workers, physicians and nurses) as messengers to disseminate messages. In addition, most of the studies employed a combination of printed materials (e.g., brochures, pamphlets, books, flyers, newsletters, billboards, blackboards, posters), nonmedia channels (e.g., workshops/seminars, voluntary counseling and testing programs, didactic lectures, peer education or outreach), and more visual materials (e.g., videos, audio tapes, VCDs and cartoon folders) to deliver messages. Three studies (Lau et al. 2008a; Tian et al. 2007; Zeng et al. 2009) used the Internet as an intervention delivery channel. Only one study (Wu et al. 2002) mentioned that radio and television were used to distribute intervention programming. In addition, a number of studies used a variety of creative small media such as coaster and making-friend cards as well as a diverse array of activities such as distribution of condoms and sterile injection equipment, group discussions and role plays. Further, a number of studies conducted larger-scale school-based and community-based programs in an effort to integrate intervention programs into regular school health education schedules and to mobilize communities.

Process evaluation

In the current review, 21 studies (46.7 %) reported conducting some type of process evaluation, for example, intensive interviews with prevention workers and focus groups with participants. Ten studies (22 %) reported that the percentage of participants who read educational materials were involved in intervention sessions, were familiar with educational materials, or received intervention manuals. Nine studies (20 %) reported message dose; for example, the days, hours, or sessions of workshops or seminars.

Outcome evaluation

In the current review, one study (2.2 %) used posttest-only control group design and 19 studies (42 %) used one-group, pretest–posttest designs. Fortunately, 25 studies (55.6 %) used a pretest–posttest control group design, which is a much stronger outcome evaluation design.

In addition, the current review found that HIV knowledge ($k = 29$, 64.4 %) and condom use ($k = 32$, 71 %) were the most common outcome measures, followed by attitudes toward people living with HIV/AIDS ($k = 8$, 19 %), condom self-efficacy ($k = 5$, 11.9 %) and attitudes toward premarital sex ($k = 3$, 7.1 %). Only three studies (7.1 %) included intention to use condoms as an outcome measure, and only one study (2.4 %) included communications on HIV as an outcome measure. Some other outcome measures included HIV/AIDS perception and awareness, HIV testing, condom use knowledge, intention to engage in HIV-related risk behaviors, and safe sex knowledge. In the studies that examined condom use, some included general condom use measures, while some others broke down the variable into more specific categories such as condom use with casual/regular partners, condom use for vaginal sex with casual/regular partners, and condom use for anal sex with casual/regular partners.

Among the 45 studies included in the current review, only one study (Lau et al. 2008b) reported that the efficacy of the intervention was not supported because no statistically significant between-group differences in HIV risk behaviors or perceptions were observed. All of the other studies reported evidence of intervention impact. However, given the fact that 19 studies (42 %) used one-group, pretest–posttest designs, it is difficult to draw clear conclusions about the impact of interventions examined in these 19 studies. Among the 25 studies that used pretest–posttest control group designs, favorable results on

intervention impact were found when comparing intervention groups with control groups.

Discussion

The goal of the current study was to systematically review HIV prevention interventions published in peer-reviewed journals prior to October 2011, and to examine this research from a health communication perspective. The comprehensive search yielded 45 articles reviewed in the current study.

Major findings

The current review examined whether HIV prevention efforts conducted in China have employed communication strategies and principles such as the use of theory, message delivery channels and messengers, message targeting, and formative research and process evaluation. We found some very interesting results in these areas. For example, very few studies (only 31 %) in the current review reported using behavior change theories; in addition, even fewer reported using information processing or message effects theories to guide intervention message design. When properly applied, behavioral theories allow researchers to identify the determinants that influence a given behavior change among a given target audience. Likewise, information processing theories and message effects theories can help make intervention messages more persuasive (Cappella 2006). Given the fact that theory-based interventions tend to be more effective in achieving intervention goals, future HIV prevention efforts in China should integrate theories of behavior change, information processing and message effects into development of intervention programs, where possible.

In addition, we found that few studies reported conducting formative and process evaluation research. Given the fact that formative research and process evaluation are essential parts of the development and evaluation of successful interventions, future intervention studies in China should recognize the importance of such research. Formative research helps ensure that intervention materials resonate with the target audience, while process evaluation helps us understand how the intervention was implemented and how the audience reacted to it. Conducting both activities is critical to the success of interventions; it is also important for these activities to be reported in published articles.

In the current review, intervention studies used average persons (e.g., peers, graduate students) and professionals (e.g., faculty members, health workers, physicians and nurses) as messengers to disseminate messages. In addition, most of the intervention studies in China employed small media materials (such as posters, flyers, pamphlets, etc.) and nonmedia channels (such as workshops/seminars, counseling and testing programs, fact-to-face communications, peer-led or outreach strategies) to deliver messages to the target audience. Only one study (e.g., Gao and Wang 2007) reported using logos as part of their educational messages. To date, there is little knowledge about whether mass media can help change HIV/AIDS-related risk-taking behaviors in China. Very few of the studies in the current review have used mass communication to reach and persuade target audiences. The increasing availability of a better television signal quality and wider channels has led to increased use of television programs for HIV prevention by the Chinese government. However, these television programs have mostly been employed by health and news agencies to raise awareness of HIV/AIDS and disseminate HIV/AIDS knowledge (Li et al. 2009). Research has also demonstrated that mass media sources, primarily television programs, were the primary and most trustworthy channels of HIV/STD information in China (Li et al. 2009). Nevertheless, even in these education and prevention programs, only general HIV-related information and knowledge have been provided and the educators were often not trained HIV/AIDS researchers or medical professionals (Li et al. 2009). In addition, the process and outcomes of this form of HIV prevention programs have seldom been evaluated. Therefore, utilizing scientifically-based mass media programs to deliver HIV prevention interventions to change attitudes and behaviors of at-risk groups, particularly via television, is greatly needed in China. Given the success of this approach in some studies (Noar et al. 2009), and the rapid growth of mass media networks and consumption in China, this remains a key priority area for future research (Li et al. 2009).

Further, in the current review, only three studies used the Internet as the message channel to deliver intervention messages. However, the Internet is becoming a promising tool for health communication because of its great popularity, broad reach and interactivity (Ybarra and Bull 2007). The eHealth field, which uses "emerging information and communication technology, especially the Internet, to improve or enable health and health care" (Eng, 2001, p. 1), is developing quickly in Western countries. Some studies have reported promising results of Internet-based HIV prevention programs (Noar and Willoughby 2012; Ybarra and Bull 2007). Therefore, in China, where Internet use has gained great popularity, future research on Internet-based HIV prevention and safer sex education is greatly needed.

The current study found only a few studies reported using message design and targeting strategies such as gay

bar-based participatory entertainment education strategy (i.e., melodrama series on condom use), oral role model story strategies or case study strategies. In addition to their primary target audience, some studies employed the strategy to target the messages on interpersonal influencers such as establishment owners, male clients of female sex workers, and health workers/physicians/nurses. However, most studies did not address message design approaches and processes, which might indicate that scholars who were not in health communication were less aware of the importance of using message design strategies and principles than communication scholars do (Noar 2006). Therefore, collaboration between scholars in communication and other disciplines might be a good way to produce more potentially effective messages. For example, the use of an entertainment education strategy (Singhal and Rogers 1999) in health communication campaigns, in which pro-condom use messages are embedded in entertainment program storylines, may be an effective message targeting approach for HIV prevention and safer sex education in China. Recent work in health narratives could also profitably inform such work (Green 2006).

Findings from the current review suggest that the most common outcome measures were HIV knowledge and condom use. Attitudes were also commonly measured. However, theoretical mediators of safer sex such as condom self-efficacy and partner communication were seldom examined. Self-efficacy and communication play very important roles in the context of HIV prevention (Dilorio et al. 2000) and safer sexual behavior (Noar et al. 2006). Therefore, future HIV prevention intervention studies should increase investigation into the roles that these two factors play in changing HIV-related risk-taking behaviors among the Chinese population. In addition, very few studies in the current review examined the influence of personality traits such as sensation-seeking or impulsivity on HIV preventive behaviors, although such traits are strongly associated with indicators of sexual risk-taking, including in China (Xiao et al. 2010). The sensation-seeking targeting approach (SENTAR), developed by Palmgreen and Donohew (2003), might be used fruitfully to identify target audiences and design messages of high sensation value to reach at-risk, sexually active Chinese young adults.

Characteristics of studies

Like Hong and Li, we looked at publication year, study location, and target population of the studies reviewed. Similar to Hong and Li, we found that studies in this area were published after the year 2000—with a large number of studies in this review being published in just the past few years. This indicates that using research-based intervention programs to prevent HIV in China is a relatively new practice, and one that is increasing in frequency. In addition, the current review found that most of the intervention studies were concentrated in Shanghai, Sichuan, Guangxi, Anhui Provinces, which is consistent with Hong and Li's findings. Further, like Hong and Li, we found FSW and IDUs tended to be main target audiences in these studies. However, while Hong and Li found only one study focusing on MSM as a target audience, we found more studies ($k = 6$) have begun to focus on the high-risk group of MSM/gay people/money boys.

HIV in China seems thus far to be a concentrated epidemic with high-risk groups such as MSM, IDUs and commercial sex workers being most affected (UNAIDS 2011). However, China is at risk of a generalized epidemic because HIV infections have spread to all 31 provinces and the absolute numbers involved are large and still on the rise (Parish et al. 2007). Therefore, more populations need to be targeted in HIV prevention interventions. Encouragingly, this review did find that some broader at-risk populations were becoming main target audiences (e.g., high school students) or being considered (e.g., physicians, nurses, unmarried youth, clients of commercial sex workers, farmers, establishment owners, villagers, etc.). More future intervention studies could consider expanding their efforts to more populations to raise the salience of HIV/AIDS in their lives and attempt to prevent a more generalized epidemic from taking hold.

Quality of studies

Methodological quality of the studies was mixed (see Table 2). In general, the studies that employed stronger pretest–posttest control group designs scored higher on the methodological scale than the one group pretest–posttest design. The average methodological quality score was relatively low (only 6.3 out of 12 points). The limited quality of these studies was primarily due to lack of randomization, a control group, quality control of the intervention, and a prospective cohort. For example, in the current review, only 14 studies randomly assigned participants into intervention and control groups and only 15 studies conducted procedures of quality control of the interventions. In addition, although the majority of studies (55.6 %) used the stronger pretest–posttest control group design, 43 % used a weaker one-group, pretest–posttest design and 2.2 % use a posttest-only control group design. Compared with the posttest-only design, the one group, pretest–posttest designs reduce some threats to internal validity by providing a baseline against post-intervention data. However, this type of design is generally considered to be a weak outcome evaluation design because it does not control for secular trends, historical events or other threats

to internal validity (Noar 2009). These results suggest that future HIV/AIDS intervention studies need to improve methodological quality over time. Continued use of stronger evaluation designs is necessary to rigorously evaluate the impact of HIV prevention interventions in China.

Conclusion

The current review illuminated the strengths and weaknesses of the literature on HIV prevention interventions in China. In this concluding section, we discuss areas for future research as well as implications for policy.

Areas for future research

The current review suggests several avenues for future research. Future HIV prevention efforts in China need to integrate appropriate theory, formative research and process evaluation into the development and implementation of intervention programs. Theories of behavior change such as the theory of planned behavior and social cognitive theory and theories of information processing and message effects such as extended parallel process model and narrative theory may be specifically culturally adapted for Chinese populations. Future research should also use diverse message targeting strategies and message delivery channels to maximize persuasiveness of interventions, and should investigate the impact of the mass media in HIV prevention efforts in China. Increased utilization of mass media, particularly using television and the Internet to change attitudes and behaviors of at-risk groups, is greatly needed in future HIV prevention efforts. A broader agenda of research on televised and eHealth interventions in HIV prevention is needed. Finally, measures must be taken to continually strengthen the quality and methods of prevention studies. More sophisticated evaluation designs that include randomized controlled trials should be utilized in future intervention research.

Implications for policy

The current review found that most HIV prevention intervention studies in China concentrated on specific audience segments in specific locations. This is a positive development, and it has implications for HIV prevention policy. That is, given the nature of the epidemic, the Chinese government must continually provide intensive support to priority populations and locations. However, the government also needs to expand efforts to more populations and more locations, as current efforts are not likely to be enough to significantly impact the epidemic. In fact, greater investment in HIV prevention in China is critical to avoid continued increases in HIV/AIDS infection and the emergence of a generalized epidemic. Given that some high-risk populations (such as migrant workers, commercial sex workers, young people) are highly mobile, government agencies within each province and between provinces need to partner together to create a united and comprehensive prevention plan.

In addition, the government must provide greater support and commitment to employ mass media (and other community-level strategies) to fight the disease. Along with the government-led mass mediated education and communication (IEC), communication tools such as news reports, public service announcements, documentaries, and themed interviews on HIV awareness and HIV-related discrimination are greatly needed.

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