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Review article

"HOW BEST CAN WE PLAN & IMPLEMENT HIV PREVENTION? A REVIEW OF SUCCESSFUL EVIDENCE BASED PRACTICES & RESEARCH

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ABSTRACT

Context: Around 2.5 million people become infected with HIV each year and its impact on human life and public health can only be tackled and reversed only by sound prevention strategies. Aim: This paper aims to provide the reader about different types of prevention strategies that are effective and practiced in various countries with special emphasis on evidence for success. It also highlights the importance of to the evidence based medicine& strategies. It describes about the importance of combination prevention, which encompasses complementary behavioral, biomedical and structural prevention strategies. **Methods & Materials:** Searches for peer reviewed journal articles was conducted using the search engines to gather the information from databases of medicine, health sciences and social sciences. Information for each strategy is organized & presented systematically with detailed discussion. **Results:** For a successful reduction in HIV transmission, there is a great need for combined effects of radical & sustainable behavioral changes among individuals who are potentially at risk. Second, combination prevention is essential for HIV prevention is neither simple nor simplistic. Reductions in HIV transmission need widespread and sustained efforts. A mix of communication channels are essential to disseminate messages to motivate people to engage in various methods of risk reduction. **Conclusions:** The effect of behavioral strategies could be increased by aiming for many goals that are achieved by use of multilevel approaches with populations both uninfected and infected with HIV. Combination prevention programs operate on different levels to address the specific, but diverse needs of the populations at risk of HIV infection.

Keywords: Biomedical interventions, Behavioral strategies, Combination prevention, HIV/AIDS, STIs, Structural interventions

INTRODUCTION

Around 2.5 million people become infected with HIV each year. This extraordinary toll on human life and public health worldwide will only be reversed with effective prevention. There is a need for combination prevention as there is for combination treatment, including biomedical, behavioral, and structural interventions. Combination prevention should be based on scientifically derived evidence, with input and engagement from local communities that fosters the successful integration of care and treatment. Combination prevention relies on the evidence informed; strategic, simultaneous use of complementary behavioral, biomedical and structural prevention strategies. Combination prevention programs operate on different levels (e.g., Individual, relationship, community, society) to address the

specific, but diverse needs of the populations at risk of HIV infection.

The Joint United Nations program on HIV/AIDS (UNAIDS) Prevention Reference Group agreed in December, 2009 that combination prevention programs are: rights-based, evidence-informed, and community-owned programs that use a mix of biomedical, behavioral, and structural interventions, prioritized to meet the current HIV prevention needs of particular individuals and communities, so as to have the greatest sustained impact on reducing new infections.

Well-designed combination prevention programs are carefully tailored to national and local needs and conditions; focus resources on the mix of programmatic and policy actions required to address both immediate risks and underlying vulnerability; and they are thoughtfully planned and managed to operate synergistically and consistently on multiple levels (e.g. individual, relationship, community, society) and over an adequate period of time.

This paper discusses about different types of prevention strategies that are effective and practiced in various countries with special emphasis on evidence for success thereby contributing to the evidence based medicine. It describes & advocates about combination prevention, which relies on the evidence informed, strategic, simultaneous use of complementary behavioral, biomedical and structural prevention strategies. It also emphasizes the importance and need of both behavioral & biomedical interventions which are both traditional and modern using the biomedical & information technology.

Behavioural Strategies: defined as "interventions to motivate behavioral change in individuals and social units by use of a range of educational, motivational, peer-led, skill-building approaches as well as community normative approaches" (Coates and Gable 2008)

They include sexual debut delay, Sexual partner reduction, Consistent condom usage, HIV counseling and testing, sexual abstinence, Monogamy, Biomedical intervention uptake and consistent usage, Adherence to harm reduction strategies. Behavioral interventions fall into two broad categories:

A. Interventions to minimize sexual risk behaviors / increase protective behaviors

Evidence

They include sexual behavior change communications (SBCC) that employ a variety of channels to communicate a range of messages. Studies have been undertaken to assess both channels of communication and the content of the messages.

Channels of communication

1. Mass media: Much of the research on mass media has focused on changes in intermediary indicators such as knowledge, risk perception, and self-efficacy. Reviews of this research have generally found small but positive effects on each of these indicators[1]. Studies have also linked mass media to reported positive behavioral outcomes such as delay of sexual debut[2], decreases in number of sexual partners[3-5], increases in condom use[6-8] and utilization of HTC and PMTCT services[9,10]. Current research suggests that mass media is most effective when used to: facilitate advocacy efforts[11]and complement other community-level and interpersonal activities. Mass media programming has been shown to produce a dose-response effect, in which higher exposure to messaging resulted in increased self-reported positive behavioral change[12].
2. Community-level interventions: Community mobilization campaigns have been shown to increase uptake of HTC in discordant couples[13] and youth[14]. Specific activities such as community-based dramas have been shown to increase HTC utilization and condom use[15]. Locally-based media programs have been shown to impact social norms, including perceptions of HIV-positive individuals[16]. While their geographic reach is often limited, effective community-based activities generally provide good results at a low cost per beneficiary, although the duration of these effects is unknown[17]. Community level activities are most effective when they: focus explicitly on community norms; develop key opinion leaders with the abilities and desire to diffuse messages widely; and facilitate support systems and networks[18].
3. Interpersonal communication: Interpersonal communication and counseling are defined as a person-to-person or small group interaction and exchange[19, 20]. A recent meta-analysis of research examining interpersonal communication found

that exposure was significantly associated with increased knowledge and condom use[21]. In addition to these outcomes, peer education has demonstrated some success in changing community attitudes and norms[22]. Cost-effectiveness studies have shown that interpersonal communication has the ability to reach hard-to-reach population groups in a cost-effective manner[23].

Focus of messages:

a. Multiple partnerships: Sexual activity with more than one partner plays a central role in all sexually-driven HIV epidemics. Ecological and associational evidence from generalized and concentrated epidemics points to a consistent pattern of significant decline in the proportion of men and women reporting multiple partners, followed by population-level declines in HIV infection[24-26]. Behavioral interventions utilizing various communication channels have had a demonstrable impact on reducing numbers of sexual partners in numerous populations including MSM, adult men and women, and young people[27,28]. While debate exists around the role of concurrent, as opposed to sequential, partnerships in HIV transmission[29], efforts to evaluate concurrency reduction interventions are on-going[30].

b. Intergenerational and transactional sex: In many settings, intergenerational sex and transactional sex are closely related[31,32]. Both practices are driven by economic needs or wants, as well as deeply-entrenched norms supporting age differences between partners and male dominance in relationships[33]. Women‘s ability to refuse sex or negotiate condom use, which may already be limited, may be further compromised by age differences between partners or exchange of money or gifts. These factors, in combination with young women‘s biological vulnerability to HIV infection, contribute to heightened risk for both young women and their male partners[34].

c. Age of sexual debut: A number of national population-based surveys[35,36]have found a correlation between early initiation of sex and higher HIV prevalence among young people. Increased mean age of sexual debut is thought to be one contributing factor in declining HIV prevalence in some generalized epidemics in sub-Saharan Africa[37]. A multi-country study of youth in sub-Saharan Africa found that programs promoting abstinence, including those utilizing mass media, could produce increases of up to one year in mean age of sexual debut[38].

d. Alcohol use: Alcohol use plays a critical role in sexual risk behavior that can lead to HIV transmission. Multiple studies have found that persons who use alcohol in sexual situations are more likely to have unprotected sex, casual sex, and multiple partners, than persons who do not use alcohol in sexual situations[39]. Alcohol consumption is linked with increased risk of STI and HIV infection[40], gender-based violence, and non-adherence to ART.

B. Supportive interventions to optimize biomedical interventions by creating demand for services and improve adherence and aftercare.

i) Creating Demand for Services

Evidence

Social and Behavior Change Communication (SBCC) has been widely used over the past decade to create demand for biomedical prevention approaches, including HTC and VMMC. HTC-focused mass media campaigns in Kenya and South Africa have been shown to increase uptake of testing services, with a clear dose-response effects[41, 42]. Evidence from South Africa further indicates that exposure to SBCC programs is associated with discussing HIV and that discussion of HIV is associated with testing — suggesting a possible indirect effect of HTC promotion interventions[43,44].

ii) Improving Adherence and aftercare through Client Education

Evidence

Creating demand for services, while essential, is not sufficient in isolation to ensure positive outcomes. Helping clients identify side effects and adverse events, take medication correctly, and care for themselves following medical procedures can all contribute to optimal use of medical technologies. A randomized control trial in Kenya found that SMS reminders significantly improved ART adherence among patients[45]. Similar approaches have been used to support attendance at VMMC follow-up visits.

I. **BIOMEDICAL INTERVENTIONS:** defined as the “interventions are those that act

directly on the biological systems through which the virus infects a new host."Some of the biomedical interventions include:

1. Male condoms: When used consistently and correctly, male latex condoms are highly effective in preventing the sexual transmission and acquisition of HIV and other STIs at the individual level[46,47]. Among Most At-Risk Populations (MARPs), increasing condom availability, accessibility, acceptability, and use has had a demonstrable population-level effect in several epidemics[48, 49]. In heterosexual sero-discordant relationships in which condoms were consistently used, HIV-negative partners were 80% less likely to become infected compared with persons in similar relationships in which condoms were not used[50].
2. Female condoms: Laboratory studies indicate that the female condom is an effective mechanical barrier to semen and viruses, including HIV[51]. In 2006, WHO concluded that female condoms, when used consistently and correctly, have comparable effectiveness to male condoms. In 2009, the FDA approved the second generation of the female condom (FC2) for prevention of HIV, other STIs, and unintended pregnancy. A growing body of evidence shows that effective female condom promotion to both women and men can increase the proportion of protected sex acts[52-54]. Studies conducted in a variety of contexts show that the female condom is widely acceptable and a realistic alternative to the male condom[55].
3. Voluntary medical male circumcision: Voluntary medical male circumcision is the surgical removal of the foreskin from the penis by trained medical personnel under aseptic conditions. Three randomized control trials indicated that VMMC reduces men's risk of HIV acquisition by 50-60%[56-58]. Extended follow-up of participants at up to five years post-trial indicated that the protective effect increased to 68%[59]. WHO and UNAIDS have concluded that VMMC should be actively promoted as part of comprehensive HIV prevention efforts in settings where circumcision rates are low and HIV prevalence is high[60]. A prospective study enrolling HIV sero-discordant couples found a promising, although not statistically significant, 40% reduction in sero-conversions of women whose male partners were circumcised[61]. A recent study suggests that VMMC, with the lifelong protection it provides, is a cost-effective strategy to prevent HIV in high-prevalence areas[62].
4. HIV testing and counseling (HTC): The evidence for the direct impact of HIV testing and counseling on HIV incidence is mixed. However, HTC, knowledge of HIV sero-status, and successful linkages to other services are critical for access to effective prevention interventions for those who test negative, and to treatment and other HIV-specific services for PLWH. In particular, HTC process allows for identification of PLWH, which in turn supports programs like treatment that can protect their HIV negative partners from infection[63]. Recent Demographic and Health Surveys from 13 sub-Saharan African and five non-African countries show a median of 12% of women and 7% of men having been tested in the 12 months preceding the survey, and a median of 34% of women and 17% of men reporting having ever been tested.
5. Diagnosis and treatment of sexually transmitted infections (STIs): Studies have shown that STIs, including those that are asymptomatic, increases susceptibility to HIV infection two- to fivefold for several reasons, including direct damage to the mucosa through ulceration that facilitates infection, and through inflammatory processes that increase the proliferation of immune cells that are also targets for HIV[64, 65]. STIs also leads to higher HIV loads in the genital secretions of HIV-positive individuals, thereby increasing the chance of infecting their sexual partners[66]. STIs are biological markers for risky sexual behaviors, increase susceptibility to HIV acquisition through genital ulcers, and increase onward transmission of HIV associated with HIV viral spikes[67-69].
6. Antiretroviral drug (ARV) -based prevention: There are four opportunities for HIV prevention: before exposure, at the moment of exposure, immediately after exposure, and as prevention focused on infected persons. Until recently, most prevention resources have been directed toward strategies aimed at preventing exposure. There is growing evidence that ART of infected

individuals has an added prevention benefit. Treatment of HIV and prevention of HIV must be considered as elements of a single continuum and deployed together.

Post-exposure Prophylaxis (PEP) for HIV: PEP refers to the set of services that are provided to manage specific aspects of exposure to HIV and to help prevent HIV infection in a person exposed to the risk of infection. These services might include first aid, including counseling, assessing the risk of HIV exposure, HTC, and, depending on the outcome of exposure assessment, a limited course of ARVs, with appropriate support and follow-up.

Evidence

Strong evidence suggests that a short course of ARVs started within 72 hours after exposure effectively reduces HIV transmission rates following needle stick exposure to HIV-infected blood. This comes largely from a single-case control study involving health care workers from France, UK & USA that revealed strong inverse associations between the likelihood of HIV infection following a needle stick injury and the post-exposure use of zidovudine[70]. However, data available from animal transmission models[71], perinatal clinical trials[72], studies of healthcare workers receiving prophylaxis after occupational exposures[73], and observational studies[74] indicate that PEP may reduce the risk of HIV infection after non-occupational exposures as well.

Treatment as Prevention

Evidence

An important determinant of risk of HIV transmission from an HIV-positive person to an HIV-negative person is the concentration of HIV in plasma. ART for the HIV-positive partner is associated with both reduced viral load[75,76] and reduced risk of HIV transmission to sex partners within discordant partnerships, potentially by over 90%[77-80]. These observational data were recently confirmed by HPTN 052, a randomized trial among 1,763 HIV sero discordant couples in which the HIV-positive partner had a CD4 count between 350 and 550 cells/μL. The trial evaluated the effect of immediate versus delayed ART (initiated at CD4 of 250 cells/μL) in the HIV-positive individual.

Pre-exposure Prophylaxis (PrEP) for HIV:

Evidence: In the CAPRISA 004 study in South Africa, 889 high-risk women used 1% Tenofovir gel vaginally up to 12 hours before intercourse and within 12 hours after intercourse[81]. This study reported a 39% reduction in HIV acquisition overall, and maximal reduction of 54% in women who were the most adherents. HIV acquisition was inversely correlated with detection of Tenofovir in the vaginal secretions, an indication of the strong association between product adherence and efficacy.

In the iPrEx study completed in 2010[82], HIV-negative MSM were provided daily Emtricitabine and Tenofivirdisoproxilfumarate (TDF+FTC) for up to 2.8 years. The study found a 44% reduction in HIV acquisition, and as with the CAPRISA trial, efficacy was strongly associated with ARV drug concentrations.

Another study, conducted by CDC in partnership with Botswana Ministry of Health, found that a once-daily tablet containing TDF+FTC reduced the risk of acquiring HIV infection by roughly 63% overall in the study population of uninfected heterosexual men and women[83].

II. **STRUCTURAL INTERVENTIONS:** They can be divided into 3 broad categories shown in figure 1 shown below[84]

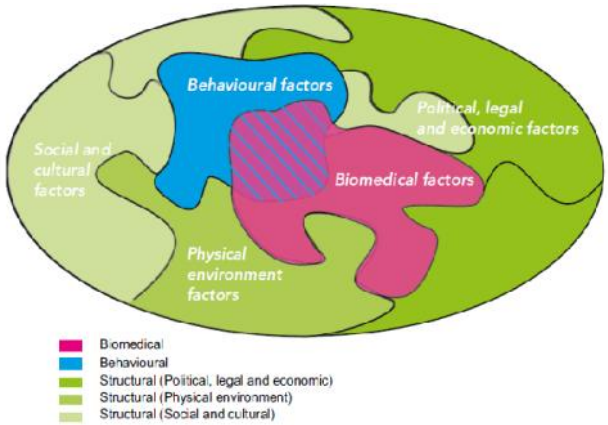

Figure 1: Interacting causes of HIV risk and vulnerability (source: UNAIDS)

A. **Social & Cultural interventions:** strategies which include Community dialogue & mobilization, to demand services, for AIDS competence, etc., Stigma reduction programs, Advocacy and coalition building for social change, Media and interpersonal communication to clarify values, change harmful social norms Education curriculum reform, expansion and quality control, Support youth leadership etc.

B. **Political, legal and economic strategies:** They include Human rights programming, Prevention diplomacy with leaders at all levels, Community Microfinance/microcredit Training/advocacy with police, judges, etc. Policies regarding access to condoms (schools, prisons etc.), Review and revise workplace policies, Stakeholder analysis & alliance building, Strategic advocacy for legal reform, Regulation/deregulation, taxes etc.

C. **Intervention strategies addressing physical environment:** They address issues like Housing policy and standards, Enhance farming, other modes of subsistence, for food security, Infrastructure development – transportation, communications, etc.

CONCLUSION

There is an urgent need for greater demand and greater support from communities and policymakers for rights-based, evidence-informed combination prevention. To build this support, prevention experts need to speak with one voice, responding in real time with strategic advocacy to overcome the prejudices and political sensitivities that have often impeded implementation of the programs most likely to reduce HIV incidence. Effective implementation of combination prevention requires sufficient personnel to define and tailor programs at the sub-national level, to synthesize available evidence, to manage multi-component programs for specific results, to conduct and apply needed research, and to implement robust monitoring, evaluation and program improvement systems as strategies are brought to scale. Quality assurance and quality improvement are just as important in behavioral and structural interventions as in the biomedical ones. And to succeed, these must be coordinated, efficient, consistent, and inspired by a shared commitment to common goals. It's worth to remember always "Prevention is better than Cure".

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REFERENCES

1. Bertrand JT, O'Reilly K, Anhang R. Systematic review of the effectiveness of mass communication programs to change HIV/AIDS-related behaviors in developing countries. Health Education Research, 2006;21(4):567-97
2. FHI. Abstinence, fewer partners& condom use are complementary messages. Arlington, FHI. 2003 *BMC Public Health* 2011, 11**:**304
3. Noar S. A 10-Year retrospective of research in health mass media campaigns: where do we go from here? *Journal of Health Communication*. 2006;1:21-42.
4. Snyder LB, Huedo-Medina TB, et al. Effectiveness of media interventions to prevent HIV transmission, 1986-2006: a meta-analysis. In Review. http://pdf.usaid.gov/pdf_docs/PCAAC329.pdf
5. Vaughan PW, Rogers EM. Entertainment-education and HIV/AIDS prevention: a field experiment in Tanzania. Journal of Health Communication. 2000; 5(1):81-100
6. Wakefield MA, Loken B, Hornik RC. Use of mass media campaigns to change health behavior. The Lancet, *2010;*376(9748):1261-71
7. Bertrand JT, O'Reilly K, Denison J, Anhang R, Sweat M. Systematic review of the effectiveness of mass communication programs to change HIV/AIDS-related behaviors in developing countries. Health Education Research.2006;21:567-97
8. Noar S, Carlyle K, Cole C. Why Communication is crucial: Meta-Analysis of the relationship between safer sexual communication and condom use. J Health Commun2006;11: 365-90
9. Marum E, Morgan G, Hightower A. Using mass media campaigns to promote voluntary counseling and HIV-testing services in Kenya. *AIDS. 2008;* 22(15):2019-24
10. Sebert Kuhlmann AK, Kraft JM. Radio role models for the prevention of mother-to-child

transmission of HIV and HIV testing among pregnant women in Botswana. Health Promotion International. 2008; 23(3):260-68
11. Abroms LC, Maibach EW. The effectiveness of mass communication to change public behavior."Annual Review of Public Health. 2008;29(1):219-34
12. Van Rossem R, Meekers D. The reach and impact of social marketing and reproductive health communication campaigns in Zambia. BMC Public Health.2007;7(1):352.
13. Chomba E, Allen S, Kanweka W. Evolution of couples' voluntary counseling and testing for HIV in Lusaka, Zambia. Journal of Acquired Immune Deficiency Syndromes.2008;47(1):108-15
14. Ngubane T. Innovative mobilization strategies for attracting at risk youth and young adults to participate in community-based voluntary counseling and testing in rural Kwa-Zulu Natal, South Africa (Project Accept - HPTN 043). XVII International AIDS Conference, August 3-8, 2008. Mexico City, Mexico.
15. Harvey B, Stuart J, Swan T. Evaluation of a drama-in-education programme to increase AIDS awareness in South African high schools: a randomized community intervention trial. International Journal of STD and AIDS. 2000;11(2):105-11
16. Goldstein S. Communicating HIV and AIDS, what works? A report on the impact evaluation of Soul City's fourth series. Journal of Health Communication. 2005;10(5):465-83
17. Donahue J, Williamson J. Community mobilization to mitigate HIV/AIDS. Report prepared by the Displaced Children and Orphans Fund and War Victims Fund Project for the United States Agency for International Development. 1999 (http://pdf.usaid.gov/pdf_docs/Pnacm936.pdf)
18. Khumalo-Sakutukwa G, Morin S, Fritz K. Project Accept (HPTN 043): a community-based intervention to reduce HIV incidence in populations at risk for HIV in sub-Saharan Africa and Thailand. Journal of Acquired Immune Deficiency Syndrome. 2008;49(4):422-431.
19. Aggleton P. Behavior Change Communication Strategies. AIDS Education and Prevention. 1997;9(2):111-23
20. AED Center for Global Health and Communication Marketing. Accessible at: http://www.globalhealthcommunication.org/strategies/interpersonal_communication_-_counseling
21. Medley A, Kennedy C, O'Reilly K. Effectiveness of peer education interventions for HIV prevention in developing countries: a systematic review and meta-analysis. AIDS Education and Prevention. 2009;21(3): 181-206
22. Maticka-Tyndale E, Barnett JP. Peer-led interventions to reduce HIV risk of youth: a review. Evaluation and Program Planning. 2010;33(2): 98-112.
23. Fung IC, Guinness L, Vickerman P. Modeling the impact and cost-effectiveness of the HIV intervention programme amongst commercial sex workers in Ahmedabad, Gujarat, India. BMC Public Health. 2007;7: 195
24. Green EC, Mah TL, Ruark A. A framework of sexual partnerships: risks and implications for HIV prevention in Africa. Studies in Family Planning.2009;40(1):63-70
25. Shelton JD. Why multiple sex partners? The Lancet. 2009;374:367-69
26. Mishra V, Hong R, Bignami-Van Assche S. The role of partner reduction and faithfulness in HIV prevention in sub-Saharan Africa: evidence from Cameroon, Rwanda, Uganda, and Zimbabwe. DHS Working Papers No. 61. Calverton, Maryland, Demographic and Health Research Division, Macro International Inc. 2009; (http://pdf.usaid.gov/pdf_docs/PNADO191.pdf)
27. Herbst JH, Sherba RT, Crepaz N. A Meta-Analytic Review of HIV Behavioral Interventions for Reducing Sexual Risk Behavior of Men Who Have Sex With Men. Journal of Acquired Immune Deficiency Syndrome. 2005; 39(2):228-41
28. Noar S. Behavioral interventions to reduce HIV-related sexual risk behavior: review and synthesis of meta-analytic evidence. AIDS and Behavior. 2008;12(3): 1090-7165.
29. World Bank, USAID. World Bank debate series: debate 4. Concurrent sexualpartnerships.2010 http://siteresources.worldbank.org/INTHIVAIDS/Resources/375798-1297872065987/Debate4SUMMARY

ConcurrentSexualPartnerships.pdf (accessed June 17, 2011).
30. Tanser F, Barnighausen T, Hund L. Effect of concurrent sexual partnerships on rate of new HIV infections in a high-prevalence, rural South African population: a cohort study. Lancet. 2011;378: 247–55.
31. Hawkins K, Price N, Mussa F. Milking the cow: young women's construction of identity and risk in age-disparate transactional sexual relationships in Maputo, Mozambique. Global Public Health: An International Journal for Research, Policy and Practice.2009; 4(2):169 -82
32. Luke N, Kurz K. Cross-generational and transactional sexual relations in sub-Saharan Africa: prevalence of behavior and implications for negotiating safer sexual practices, Population Services International and International Center for Research on Women. Washington, DC, AIDSMARK Reoprt 2002; [http://allafrica.com/healthafrica/cca/resources/view/00010860.pdf]
33. Dunkle KL, Jewkes RK, Brown HC. Transactional sex among women in Soweto, South Africa: prevalence, risk factors and association with HIV infection. Social Science and Medicine.2004;59(8):1581-92.
34. Leclerc-Madlala S. Age-disparate and intergenerational sex in southern Africa: the dynamics of hypervulnerability. AIDS. 2008;22(Suppl 4), S17-S25
35. Munjoma MW, Mhlanga FD. The incidence of HIV among women recruited during late pregnancy and followed up for six years after childbirth in Zimbabwe. BMC Public Health, 2010;10: 668
36. Busza JR, Balakireva OM. Street-based adolescents at high risk of HIV in Ukraine. Journal of Epidemiology and Community Health, J Epidemiol Community Health (2010). doi:10.1136/jech.2009.097469;pg 1-5 (http://jech.bmj.com/content/early/2010/09/23/jech.2009.097469.full.pdf+html)
37. Bessinger R, Akwara P, Halperin DT. Sexual behavior, HIV, and fertility trends: a comparative analysis of six countries. Chapel Hill, MEASURE Evaluation Project. Phase I of ABC study 2003; (http://www.cpc.unc.edu/measure/publications/special/abc.pdf)
38. FHI. Abstinence, fewer partners, &condom use are complementary messages. Arlington, FHI. 2003 https://www.iywg.org/sites/iywg/files/yl8e.pdf
39. Kalichman, SC, Leickness CS, Vermaak R. HIV/AIDS risk reduction counseling for alcohol using sexually transmitted infections clinic patients in Cape Town, South Africa. Journal of Acquired Immune Deficiency Syndrome, 2007; 44 (5):594–600.
40. Li Q, Li X, Stanton B. Alcohol use among female sex workers and male clients: an integrative review of global literature. Alcohol and Alcoholism. 2010;45(2), 188-99
41. Marum E, G. Morgan. Using mass media campaigns to promote voluntary counseling and HIV-testing services in Kenya. AIDS 2008; 22(15): 2019-2024.
42. Kincaid L. AIDS communication programs, HIV prevention, and living with HIV/AIDS in South Africa. Pretoria, JHHESA. (jhhesa.org/sites/default/files/pdfs/23_National_HIV_and_AIDS.pdf)
43. Gay J, Hardee K, Croce-Galis M. What works for women and girls: evidence for HIV/AIDS interventions. New York, Open Society Institute. 2010: Pg 530 (http://www.popline.org/node/217238)
44. Johnson S. Second National HIV Communication Survey. Pretoria, JHHESA. (jhhesa.org/sites/default/files/.../03_National_Communication_Survey.pdf)
45. Lester R. Effects of a mobile phone short message service on antiretroviral treatment adherence in Kenya: a randomized control trial. Lancet. 2010;376:1838-45.
46. Foss AM, Hossain M. A systematic review of published evidence on intervention impact on condom use in sub-Saharan Africa and Asia. Sexually Transmitted Infections. 2007;83(7), 510-16
47. Weller SC, Davis K. Condom effectiveness in reducing heterosexual HIV transmission. Cochrane Database of Systematic Reviews. CD003255. *Cochrane Database of Systematic*

*Reviews*2007, Issue 4. (http://apps.who.int/rhl/hiv_aids/cd003255/en/)
48. Saphonn V, Heng S. Current HIV/AIDS/STI epidemic: intervention programs in Cambodia, 1993-2003. AIDS Education and Prevention. 2004;16(Suppl A), 64-77
49. Mehendale SM, Gupte N. Declining HIV incidence among patients attending sexually transmitted infection clinics in Pune, India. Journal of Acquired Immune Deficiency Syndromes. 2007; 45(5):564-69
50. Weller S, Davis, K. Condom effectiveness in reducing heterosexual HIV transmission. Cochrane Review. In: The Cochrane Library. Chichester, UK: John Wiley & Sons, Ltd. 2003 Issue 4
51. Drew WL, Blair M. Evaluation of the virus permeability of a new condom for women. Sexually Transmitted Diseases.2009;17(2), 110-12
52. Shane B, Herdman C. The female condom: significant potential for STI and pregnancy prevention. Outlook. 2006; 22(2): 40-42
53. Vijayakumar G, Mabude Z, Smith J. A review of female-condom effectiveness: patterns of use and impact on protected sex acts and STI incidence. International Journal of STD and AIDS. 2006;17(10):652-59
54. Hatzell T, Feldblum PJ. The female condom: is "just as good" good enough? Sexually Transmitted Diseases.2003;30 (5), 440-42.
55. French PP, Latka M, Gollub EL. Use-effectiveness of the female versus male condom in preventing sexually transmitted disease in women. Sexually Transmitted Diseases. 2003;30(5):433–39
56. Auvert B, Taljaard D, Lagarde E. Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 trial. PloS Medicine,2005;2(11): e298
57. Bailey RC, Moses S, Parker CB. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. The Lancet. 2007;369(9562), 643-656.
58. Gray RH, Kigozi G, Serwadda D. Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. The Lancet. 2007;369(9562): 657-66
59. Kong X. Long term effects of male circumcision on HIV incidence and risk behaviors during post trial surveillance in Rakai, Uganda. CROI. (http://www.hivandhepatitis.com/2011_conference/croi2011/docs/0311_2010c.html)
60. WHO and UNAIDS.WHO and UNAIDS announce recommendations from expert meeting on male circumcision for HIV prevention. 2007, 28th March). Accessible at: http://www.who.int/hiv/ mediacentre/news68/en/index.html.
61. Baeten JM, Donnell D, Kapiga SH. Male circumcision and risk of male-to-female HIV-1 transmission: a multinational prospective study in African HIV-1 sero-discordant couples. AIDS. 2010;24(5):737-44
62. UNAIDS/WHO/SACEMA. Male circumcision for HIV prevention in high HIV prevalence settings: what can mathematical modeling contribute to informed decision making? (2009). Accessible at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2731851/.
63. Cohen MS, Chen YQ, et al. (2011). Prevention of HIV-1 infection with early antiretroviral therapy. New England Journal of Medicine. 2011;365:561-62
64. Fleming DT, Wasserheit JN. From epidemiological synergy to public health policy and practice: the contribution of other sexually transmitted diseases to sexual transmission of HIV infection. Sexually Transmitted Infections. 1999;75:3-17
65. Wasserheit JN. (1992). Epidemiologic synergy: interrelationships between human immunodeficiency virus infection and other sexually transmitted diseases. Sexually Transmitted Diseases, 9, 61-77
66. Galvin R, Cohen MS. The role of sexually transmitted diseases in HIV transmission. Nature Reviews Microbiology. 2004;2(1), 33-42
67. Holmes KK, Sparling P. Sexually Transmitted Diseases, 4th Edition. New York, McGraw Hill, (4^{th}Edn),2008;1958-76.
68. Sobngwi-Tambekou J, Taljaard D, Lissouba P. Effect of HSV-2 serostatus on acquisition of HIV by young men: results of a longitudinal study in

Orange Farm, South Africa. Journal of Infectious Disease.2009;199,958–64
69. Barnabas RV, Wasserheit JN. Riddle of the Sphinx revisited: the role of STDs in HIV prevention. Sexually Transmitted Diseases. 2009;36(6):365-7
70. Cardo DM, Culver DH, Ciesielski CA. Case–control study of HIV sero conversion in health-care workers after percutaneous exposure to HIV-infected blood New England Journal of Medicine, 1997;337:1485–90
71. Otten RA, Smith DK. Efficacy of post exposure prophylaxis after intravaginal exposure of pig-tailed macaques to a human-derived retrovirus (human immunodeficiency virus type 2). Journal of Virology. 2000;74:9771–75
72. Shaffer N, Chuachoowong R, Mock PA. Short-course zidovudine for perinatal HIV-1 transmission in Bangkok, Thailand: a randomized controlled trial. Lancet; 1999;353:773–80
73. Cardo DM, Culver DH, Ciesielski CA. A case-control study of HIV seroconversion in health care workers after percutaneous exposure. New England Journal of Medicine. 1997;337:1485–90
74. Harrison LH, Do Lago RF. Post-sexual-exposure chemoprophylaxis (PEP) for HIV: a prospective cohort study of behavioral impact [Abstract 225]. Presented at the 8th Conference on Retroviruses and Opportunistic Infections, Chicago, Illinois, 2001;February 4–8.
75. Coetzee D, Hildebrand K, Boulle A. Outcomes after two years of providing antiretroviral treatment in Khyelitsha, South Africa. AIDS. 2004;18(6), 887-95
76. Crum NF, Riffenburgh RH, Wegner S. Comparisons of causes of death and mortality rates among HIV-infected persons: analysis of the pre-, early, and late HAART (highly active antiretroviral therapy) eras. Journal of Acquired Immune Deficiency Syndrome. 2006;41:194-200
77. Quinn TC, Wawer MJ, Sewankambo N. Viral load and heterosexual transmission of human immunodeficiency virus type 1. New England Journal of Medicine. 2000;342:921-29
78. Attia S, Egger M, Muller M. Sexual transmission of HIV according to viral load and antiretroviral therapy: systematic review and meta-analysis. AIDS. 2009; 23(11):1397-1404.
79. Donnell D, Baeten JM, Kiaire J. Heterosexual HIV-1 transmission after initiation of antiretroviral therapy: a prospective cohort analysis. Lancet. 2010;375(9731):2092-8.
80. Del Romero J, Castilla J, Hernando V. Combined antiretroviral treatment and heterosexual transmission of HIV-1: cross sectional and prospective cohort study. British Medical Journal. 2010;340, c2205.
81. Karim QA, Karim SS, Frohlich JA. Effectiveness & safety of tenofovir gel, an antiretroviral microbicide, for prevention of HIV infection in women. Science. 2010;329(5996):1168-74
82. Grant RM, Lama JR, Anderson PL. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. New England Journal of Medicine. 2010;363(27), 2587-99
83. Thigpen MC, Kebaabetswe PM, Smith DK. Daily oral antiretroviral use for the prevention of HIV infection in heterosexually active young adults in Botswana: results from the TDF2 study. 6th International Conference on HIV Pathogenesis, Treatment and Prevention. July 17-20, 2011, Rome, Italy. Abstract WELBC01.
84. UNAIDS Discussion paper Combination HIV Prevention: Tailoring and Coordinating Biomedical, Behavioural and Structural Strategies to Reduce New HIV Infections. 2010 http://www.unaids.org/en/media/unaids/contentassets/documents/unaidspublication/2010/JC2007_Combination_Prevention_paper_en.pdf