



RISKY TEENS: INTERVENTION SCIENCE AND ITS APPLICATION TO THE SOUTH AFRICAN CONTEXT

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CONTENTS

INTRODUCTION	2
PART 1: INTERVENTIONS FOR HIGH-RISK TEENS	3
I. CORRELATES AND PREDICTORS/TARGETS FOR INTERVENTION	3
II. PREVENTION SCIENCE IN DEVELOPMENTAL PSYCHOPATHOLOGY	5
III. DESIGNING AN INTERVENTION STUDY	7
Subject characteristics	7
Program characteristics	7
Method characteristics	7
IV. MULTIPLE COMPONENT INTERVENTION	8
V. ADOLESCENT PROBLEM GAMBLING	9
PART 2: A REVIEW OF INTERVENTION STUDIES AMONG SOUTH AFRICAN ADOLESCENTS	10
I. INTRODUCTION	10
II. METHODS	12
Search strategy	12
Selection criteria	12
Data collection and analysis	12
III. RESULTS AND DISCUSSION	12
Targeted risk behavior	12
Methodological considerations	12
Intervention efficacy	13
Theory and programs	13
Formative research/ process evaluation	14
PART 3: CONCLUSION	15
TABLE 1	16
TABLE 2	20
TABLE 3	23
REFERENCES	26

INTRODUCTION

The traditional domains of risky behavior among adolescents include tobacco, drugs, alcohol and sexual behavior that may lead to unwanted pregnancy or sexually transmitted disease (STD). More recently relatively understudied domains have been added, such as suicide and gambling (Romer, 2003), as well as cutting, binge eating, self-induced vomiting, unhealthy dietary habits, inadequate physical activity, firearm related injuries, aggression and violence. Especially with risk domains that are not yet widely recognized as potential threats to public health (e.g. adolescent gambling) the opportunity exists to use the past as a guide to curb the adverse consequences of new forms of risk behaviour. That gambling in particular has the potential to become a public health problem amongst adolescents is made possible by the now easy access that the internet provides to gambling opportunities in combination with the fact that gambling restrictions have been lifted in recent years in many countries as well as an increase in state sanctioned gambling activity (e.g., lottery and scratchcards).

Research has shown that teens with one problem behavior (e.g., smoking) tend to engage in other risk-taking behavior (e.g., high-risk sexual behavior, drinking, violence). Annual surveys conducted by government agencies in the US such as the Substance Abuse and Mental Health Services Administration (1999), National Institute on Alcohol Abuse & Alcoholism (1996) and the National Highway Traffic Safety Administration (2001) have shown that alcohol use is related to serious conduct problems (drunk driving, homicide, violent crimes, risky sexual behavior). These large-scale epidemiological studies have, across the board, demonstrated that risk behaviors (most notably alcohol, cigarettes, marijuana and gambling) tap into one underlying “risk factor” that may share a common pathway in development (Romer, 2003). Moreover, adolescents themselves are aware that risk behaviors are not exhibited as separate characteristics. Given the high co-occurrence of different types of risky behavior in one individual, it is not surprising that 18% of youth engaging in more than one high-risk behavior account for 65% of drunk driving, 88% of violent arrests, 72% of all arrests, 87% of drug-related health problems and 75% of improper needle use.

Adolescence is a developmental phase of interest when it comes to risk-taking behavior for several reasons. First, it is a stressful period of transition into adulthood, characterized by hormonal, physical, emotional and cognitive changes (Alloy, Zhu & Abramson, 2003). Adolescents have to cope with many complex issues such as identity, self-image, independence and intimacy. Moreover, animal research has shown that the adolescent brain may be especially vulnerable to the stimulating effects of both novel environment and drugs of abuse (Laviola et al., 1999).

Notwithstanding its unique developmental characteristics, adolescence also poses unique challenges to effect sustained response to intervention for several reasons (Stanton & Burns, 2003). The entrance of adolescents into risky behavior is not absolute, not uniform, and does not follow a particular set pattern; varying by gender, ethnicity, socioeconomic status, geographic location and temporal factors. Second, the interactive relationships between adolescent cognition, emotion and behavior vary throughout adolescence and between adolescents. Given the above complexities in definition, types of risk-taking and adolescence as developmental phase, the literature in this field is vast and fragmented across risk-taking type (Byrnes, 2003). Most research has failed to acknowledge the comorbidity among risk behaviors and the mediators that may explain the covariations among them (Romer, 2003).

Against this background, the aim of the current report was to summarize the literature on interventions for high-risk behaviors in teens so as to facilitate the evaluation of intervention programs in South Africa. To this end, we organize reviewed material in three parts. In Part I we present a general overview of the international literature on interventions for high-risk teens, with a specific focus on school-based interventions. We begin with a discussion of the correlates and predictors of risky behaviors in teens, which serve as targets for intervention in school-based programs. Next, we discuss the principles of intervention science in developmental psychopathology with the aim of putting in context the practical details for designing and evaluating an intervention study. We then justify multiple component interventions as the way of the future. We complete Part I with a review of intervention literature on adolescent problem gambling as problem gambling constitutes the main focus of the research work funded by the South African Responsible Gambling Foundation. In Part II, we take a closer look at South African-specific challenges in applying intervention science to South Africa’s unique context. We conducted a narrative review of South African school based interventions focused on preventing or reducing high-risk behavior among adolescents (13 -18) in the last 15 years (1994 – 2009). Our aim here was to distill generic principles that may guide the development and implementation of adolescent risk behaviour interventions in South Africa. In Part III we summarize main findings and conclude with general recommendations for the evaluation of intervention studies.

PART I: HIGH-RISK BEHAVIOR AND INTERVENTION SCIENCE

I. Correlates/predictors of risky behavior: targets for interventions

Many assumptions have been made about why adolescents demonstrate increased risk behavior. However, as Byrnes (2003) and others (e.g. Steinberg, 2003) have pointed out, many of those assumptions are simply not true. In what follows we recount some of the common myths, as described by Byrnes (2003).

First, it is assumed that *adolescents take risks because they lack knowledge about the consequences of risky behavior*. Research has shown that adolescents are fully aware of the risks involved in certain behaviors and that exclusively knowledge-based interventions are largely ineffective across various domains (DiClemente, Hansen, & Ponton, 1996). Others have postulated that *adolescents take risks because they think they are invulnerable*. Evidence for an invulnerability or “egocentric” hypothesis regarding risk-taking behavior stems from research showing that adolescents acknowledge negative consequences of risk taking behavior, but that they don’t think it applies to them personally. However, other research has shown that teens often overestimate the chance of death in the near future (Fischhoff et al., 2000). Given the mixed results in this area it is fair to conclude that at best, egocentrism may be correlated with risk-taking behavior without necessarily causing it (Cauffman & Steinberg, 2000).

A third myth which is often assumed is that *all forms of risk-taking have negative consequences*. However, as Byrnes and Miller (1997) points out, the more accurate perspective is that effective living follows from the ability to discriminate between risk that should be taken and risks that should be avoided. The authors therefore suggest that the difference between teens with problems in the risk-taking domain and those without is a question of *judgment* between bad risk vs. good risk.

It is, furthermore assumed that *males are more likely to take risks than females*. Although a meta-analysis of 150 studies has shown this to be true (Byrnes, Miller & Schafer, 1999), it is also true that most studies focus on the kind of risk-taking that boys are more likely to engage in (e.g., taking risks while driving). Research is therefore biased towards studying those risk behaviors more associated with males and may underestimate risk behaviors more associated with females.

Another assumption is that *decision making in adolescents can be improved simply by giving teens metacognitive insight into the nature of decision making*. These psychoeducation programs often make use of hypothetical scenarios to provide adolescents with insight into their poor decision-making strategies and teach them self-regulation strategies for those hypothetical situations. However, as Byrnes (2001) discusses, “rule-of-thumb” information imparted during psychoeducation programs rarely translate into actual situations where teens are faced with risky choices (Byrnes, 2001). The reason for this is that real-world decision-making is significantly influenced by emotional responses that cannot be simulated during vignette style psychoeducation. Indeed, lab studies of risky behavior in teens often *minimize emotional influences* on decision making to increase the rigor of experiments. For instance, a lab study may ask adolescents to take risks in a card playing game and to ensure that the game is a measure of cognitive decision-making, the game will be set up such that factors that may cause emotional responses (like peer pressure) is minimized in the game. Such lab experiments do not adequately mirror real-life decision-making scenarios, as most of the important decisions we make take place under conditions of significant emotional arousal (Steinberg, 2003). The focus on *cognitive processes during risk-taking behavior (decision-making)* that characterizes so much of the risk-taking literature in adolescence is therefore criticized by studies suggesting that feeling, more than thinking, may be driving risky decision-making during a risk-taking event. Therefore, some researchers advocate a focus on emotional processes instead of cognitive processes for developing an understanding of risk-taking behavior in teens (Steinberg, 2003).

Finally, despite the fact that research clearly shows that in many instances risk taking behavior is a group phenomenon (e.g. delinquent acts [Zimring, 1998] drinking [Udry, 1998], and driving [Simpson, 1996]), risky teen behavior tends to be studied “one teen at a time”. In other words, when researchers design their studies they neglect to investigate the influence of peers on risk taking behavior. This is important because of all the risk factors for risk-taking behavior peer group has been shown to be the most powerful predictor.

With these myths addressed, we now turn our attention to correlates and predictors of risky behavior which may form targets for intervention. A correlate does not, of course, imply causation. In the absence of longitudinal research it is very difficult to establish the etiological (causal) status of any correlate. For example, if high emotional arousal in an experimental task is found to be statistically associated with risky decision-making, it does not necessarily follow that the latter is caused by high emotional arousal. To test that question definitively a researcher would first have to measure emotional arousal in adolescents who do not exhibit risky decision-making and then follow them up over time to see if those with a tendency for high arousal develop risky decision-making over time. If so, one may conclude that high arousal levels may be a causative factor in risky decision-making. If not, it means that emotional arousal is a merely a correlate (or “epiphenomenon”) of risky decision-making. And even if a risk factor has been established as causative, that risk factor may not be amenable to change. For instance, there is no intervention for the genetic influence known to be associated with risk taking behavior (Kendler, Gardner, Neale & Prescott, 2001; van den Bree, Johnson, Neale, Svikis, et al., 1998). In such cases, researchers look to identify gene-environment interactions (“endophenotypes”) to identify particular cognitive, emotional or environmental factors that may be targeted for intervention in order to alter gene expression. Finally, correlates or risk factors for any maladaptive outcome (like risky decision-making) are likely to interact with other correlates or risk factors. Therefore, the list that we present below should not be targeted in isolation during intervention – a point to which we will return.

Decision-making. Compared to adults, adolescents show reduced capacity for effective decision-making and problem-solving (Millstein, 2003). Adolescent decision-making is also particularly vulnerable to the effect of emotions (Slovic, 2003). Researchers who view poor decision-making as one of the main reasons for risky behavior in adolescents suggest that adolescents can be taught to be better decision-makers. Interventions based on this line of research include generating alternative solutions to problems, recognizing the perspectives of others in problem-solving, and appreciating the need for planning (Hall Jamieson & Romer, 2003).

Values and judgment. While several studies have demonstrated poor decision-making capacity in teens, other studies have reported equal capacity to perceive and appraise risk in adults and teens. Against this background, Steinberg (2003) suggested that risk-taking behavior in adolescents is a question of judgment (values) rather than decision-making. Three sets of psychological factors affect judgment according to this approach: responsibility (the capacity for autonomous/independent behavior that is not unduly influenced by others), perspective (the capacity to place a decision within a temporal and social context), and temperance (the capacity to regulate one’s impulses) (Steinberg & Cauffman, 1996). These cognitive factors have been shown to be accentuated under conditions of high emotional arousal (e.g. excitement), and when functioning in groups (Steinberg, 2003). Despite some support for this approach to risky teen behavior, it raises the question as to how to intervene: how does one teach emotional and social maturity? It is not surprising that Steinberg (2003) suggests limiting of opportunity as the more profitable strategy for preventing the harmful consequences of immature judgment. Limiting opportunity may be a good strategy for preventing some teenage risk behavior (e.g. limiting access to guns has been found to reduce teenage gun accidents), but may be less helpful for other teenage risk behavior. For instance, abstinence programs to prevent teenage pregnancy have been shown to have the opposite effect (Trenholm et al., 2007).

Risk perception and judgment. Risk perception includes an individual’s beliefs about risk and vulnerability (e.g. “I’m invincible – I can drink as much alcohol as I want!”), the tendency to worry about things that may have negative consequences (e.g. “I am easily put off from doing risk things out of fear of getting hurt”) and the level of anxiety produced by perceived risk (Millstein, 2003). Risk judgment focuses on potential outcomes (“What is the chance I will get an STD?”) or situations (“Is having unprotected sex dangerous?”). Risk perception has been seen as having a fundamental impact on teen risk behavior and has therefore been incorporated into many school-based intervention programs (Beyth-Marom, Austin, Fischhoff, Palmgren & Jacobs-Quadrel, 1993; Johnston, 2003; Fishbein, 2003). Millstein (2003) summarizes a risk perception model by which primary (“Is there potential risk?”) and secondary (“Am I at risk?”) appraisal processes interact with other cognitive processes (knowledge, memory, information processing, attention) and affect (mood states, emotion regulation) to produce risk-taking behavior. Typically, research has focused on primary appraisal processes in lab situations without acknowledgment of emotional processes. Authors of risk-perception research are therefore advocating that new studies take into account the role of emotions so that experiments are more consistent with the real-life circumstances in which teens find themselves.

Time perspective. This approach focuses on the temporal asymmetry between costs and benefits related to health behaviors. In other words, some individuals choose to invest in immediate payoffs instead of taking a long-term perspective. Due to this asymmetry individuals fail to appreciate the importance of adopting and maintaining health-protective behaviors at the time of decision making (Fong & Hall, 2003). For example, evidence suggests that teens smoke because they want to convey a positive image to themselves and others (Barton, Chassin, Presson, & Sherman, 1982; Belk, Mayer & Driscoll, 1984). However, in time, the balance of costs and benefits become reversed. Research has shown that college students with a longer term time perspective engaged in healthier behaviors than those with a short-term time perspectives. Time perspective may therefore be a useful target for intervention.

Impulsiveness and sensation-seeking. These are seen as personality traits that may be biologically based (Lerman, Patterson & Shields, 2003) and which are associated with a general risk-taking attitude, as well as with the use of tobacco, alcohol, and illicit drugs (Zuckerman & Kuhlman, 2000). Romer (2003) found that one risk factor underlies alcohol, cigarettes, marijuana and gambling and that this risk factor is positively associated with sensation-seeking and negatively associated with prosocial behavior. The fact that sensation-seeking (which is biologically and genetically determined) may underlie many risk-taking behaviors poses a problem for intervention studies because, for instance, it is not clear if decision making skills can be taught to youth who by nature tend to seek out novel and highly stimulating (dangerous) activities. Channeling their needs for stimulation may be better. Alternatively, interventions should be targeted such that they grab the attention of individuals high in sensation-seeking. For example, in advertising this would translate to loud, colorful, vivid approaches designed to generate sensory and affective responses. For school-based programs, interventions will include action-adventure activities that may grab the attention of high sensation-seekers (D'Silva, Harrington, Palmgreen, Donohew & Lorch, 2001).

Depression. Research has clearly shown an association between depression and risk taking behavior, including substance abuse (Loeber et al., 1998), cigarette smoking (Killen et al., 1997), and teenage pregnancy and parenthood (Kessler et al., 1997). It is unclear to what extent depression causes risk-taking behavior; to what extent it is a consequence of such behavior; and to what extent the two reciprocally interact. In any case, it is clear that depression should be assessed for determining its contribution in interventions of high risk behavior (Alloy, Zhu & Abramson, 2003).

School atmosphere and connectedness. Qualitative studies have shown that schools where youth experience trust amongst peers, teachers and themselves have reduced risk-taking behavior (LaRusso & Selman, 2003). This kind of research fits with the new wave of intervention research for risky teen behavior that focuses not so much on identifying risk factors for risky behavior, but on protective factors (Guerra, & Bradshaw, 2008). Such research advocates that school intervention programs should focus on building on youth's strengths. These strengths may include a positive self-esteem, self-control, decision-making skills, a moral belief system and prosocial connectedness (e.g. school connectedness or school bonding). The extent to which this approach to intervention research is prioritized above a risk model is evidenced by the 2010 Center for Disease Control (CDC) call for applications for funding addressing ways to increase connectedness in teen environments in order to reduce high-risk behaviors.

II. Prevention science in developmental psychopathology

Formats for interventions targeting risky behavior in adolescents have included direct interventions (e.g. face-to-face), small groups (formed either by a researcher or "naturally" formed"), classrooms and individuals (e.g., clinics), media-based interventions (stand-alone posters, movies, brochures, and larger, more integrated campaigns), and indirect interventions (e.g., targeting physicians, parents, peers) (Stanton & Burns, 2003). Whichever approach is taken, prevention science is generally characterized by three logically sequential stages (Dodge, 2001). The first stage includes prospective, descriptive, and laboratory studies to shape knowledge of how the target behavior develops. Often these studies formulate the target of intervention and describe the mechanism by which the intervention is hypothesized to affect change (Johansson & Høglend, 2007). In the second stage, the knowledge is applied to develop novel intervention plans which are tested in relatively rigorous (pristine) circumstances namely *efficacy trials*. During the third stage, interventions that have proven to be efficacious under ideal circumstances are tested under more natural circumstances of the "real-world ecology" – these studies are called *effectiveness studies*.

For example, suppose that problem gambling in adolescents is identified as a public health problem in South Africa. Researchers may hypothesize that poor decision-making capacity in teens lie at the basis of excessive gambling behavior. To test this hypothesis, researchers will carry out laboratory studies to establish a concurrent link between gambling behavior and decision-making capacity. Next, they will carry out a longitudinal study to establish the causal role of poor decision-making for the development of gambling problems in adolescents. Once poor decision-making has been established as a viable target for intervention, the researchers can move on to the second stage to develop a novel intervention strategy and to test this under rigorous, albeit superficial circumstances. For instance, the researchers may recruit a group of teens through advertisements to undergo an intervention designed to improve their decision-making capacity. This group may be compared to a group who undergo a knowledge-based intervention where teens are given educational material about the negative consequences of gambling. This kind of study is called an efficacy trial because it does not mirror real-life circumstances well. Once an intervention has demonstrated promise under these conditions, the third stage where the intervention is tested in the real world can be attempted. In our example, researchers may decide to deliver their intervention in a school to see if children who are not self-selected to participate in a research study also improve in their decision-making capacity with associated reduced rates of problem gambling. Below, we give more detail on issues to consider in the three-stage approach described here.

Stage 1: identifying correlates or risk factors (Dodge, 2001): Once consensus in the field has been reached regarding the major correlates and predictors of disorders (e.g. decision-making), researchers must pay attention to *cumulation* (the fact that different risk factors provide unique increments in the prediction of problem behavior – targeting one factor therefore will have limited success). Researchers must also pay attention to *equifinality* (the fact that there are multiple pathways to problem behavior and that all children will not follow the same pathway). Researchers must also be aware of *moderation effects* of certain factors. For instance, biological predisposition may be altered by life experience such that outcomes can be predicted for one group of children with a particular set of life experiences but not for another group of children. Finally, researchers need to pay attention to *mediating factors*. These are the mechanisms of change (that is, causal factors that effect change), but which are developmentally sensitive and thus may have more immediate or distal influence in the development of problem behavior. For instance, the causative effect of decision-making as a risk factor for high-risk behavior will depend on whether the target population includes teens in early vs. late adolescent phases.

Stage 2: Efficacy (laboratory) studies (Dodge, 2001): Intervention studies based in developmental research (as described in Stage 1) have a higher chance of succeeding in efficacy studies than those that have ignored Stage 1 (e.g. Tremblay, 1999). Even so, the success of intervention studies in general has been found to be modest, especially if they target only one risk factor. Therefore, a multimodal approach targeting many risk factors, across clusters of risky behavior is now the aim of most new prevention programs for high-risk teen behavior (Flay, 2003).

Stage 3: Efficacy (real-world) studies (Dodge, 2001): There are multiple challenges involved in translating efficacy studies from university clinic settings to real-life settings. First, collaboration between researchers and community leaders is crucial. Issues that need to be negotiated include agendas that serve both parties, delegation of responsibilities, flexibility during mid-course, and endorsement of random assignment to treatment conditions (Evans et al., 2001). For instance, in a South African context researchers may be interested in advancing science through their intervention study while community leaders may be interested in the immediate alleviation of a problem. As such, researchers may require that only half of the community undergo the intervention so that the effects of the intervention can be compared with a non-intervention group. This kind of random assignment of treatment conditions may not appeal to community leaders who would like to see all members of the community benefit from a research collaboration. Negotiations around who will be taking responsibility for different phases of the study (recruitment of participants, data collection, data management, publication of findings) can be complicated especially because researchers often have to rely on unpaid community leaders to help with recruitment. Moreover, intervention studies are notoriously unpredictable and both researchers and community leaders need to be flexible to adapt to changing circumstances.

A second challenge in efficacy trials is that the study participants should ideally be representative of the wider population and should be retained throughout the study. According to Prinz et al., (2001) the following may help in improving recruitment and retention: personalized recruitment (i.e. face to face recruitment instead of advertisements), indigenous staff (e.g. Xhosa speaking staff to assist in recruitment if the target population is Xhosa), capitalizing on opportune moments in the teen's life (e.g. transition to high school), matching of target population's natural interests (e.g. academic skills development). These steps will be crucial in making sure that a representative sample is recruited and retained for an intervention study.

Fidelity (adherence) to the treatment protocol is crucial for the success and "publishability" of the study. If a study cannot demonstrate that all those delivering the intervention followed the content and structure of the intervention, it is hard to know if study results are due to the intervention or some person-specific factor. Loss of fidelity may be caused by insufficient training of those delivering the intervention, lack of enthusiasm and ownership of the intervention or no outlined contingencies for failure to adhere to the protocol. Dumas, Lynch, Laughlin, Phillips, Smith & Prinz (2001) advise that careful selection and training of interventionists, regular supervision, manualization of protocols and review of written records may increase fidelity.

The last challenge facing intervention studies relate to the acknowledgement of cultural diversity. The problem of adapting an intervention that has been developed for one cultural grouping is generally a challenge (Alkon, Tschann, Ruane, Wolff, & Hittner, 2001), but is especially relevant for the South African context where cultural diversity is the norm. Researchers should also consider that factors identified in Stage 1 of the research program may be different for different cultural groupings.

III. Designing an intervention study

Because most children move through the educational system, schools are an important setting for interventions to prevent high-risk behavior in teens. A review of the school-based intervention literature for high-risk behavior in teens has revealed the following list of decisions that need to be made when designing an intervention. Generally, these decisions can be organized around three headings: subject characteristics, program characteristics and method characteristics.

Regarding *subject characteristics*, those designing an intervention need to decide exactly who the intervention is for. Will the intervention be focused on both genders or just boys or girls? What will be the age of the participants – early or late teens? Would the intervention be focused on one ethnicity or language group? Similarly, socio-economic status, and the risk status of the participants (high risk or low risk) need to be decided. As discussed above, all of these decisions may impact the success of the intervention program, or may moderate its effect.

Several *program characteristics* need to be considered in designing an intervention. Interventions may be universal (e.g. whole school or whole class), comprehensive (whole community) or targeted (e.g. special education classes). Those delivering the intervention must be decided on. These may include teachers, the researchers themselves, or multiple interventionists. The treatment protocol may be delivered individually, in a group format, or a mixture of the two. The length of the intervention should be decided (most are around 10-20 weeks). The frequency of service contact should be discussed (e.g. less than weekly contact with students; 1 or 2 x per week; 3 or 4 x per week; daily contact). Importantly, the treatment modality needs to be decided on. According to Wilson and Lipsey (2007) intervention programs may include *behavioral* techniques, such as rewards, token economies, contingency contracts, aimed at modifying or reducing inappropriate behavior; *cognitive* techniques which are focused on changing thinking or cognitive skills, and *social skills training* designed to help youth better understand social behavior and learn appropriate social skills (e.g., communication skills, interpersonal conflict management). An important program characteristic is whether parents will be involved in the intervention. Parent involvement has been shown to be a crucial ingredient of intervention studies (Wilson & Lipsey, 2007) but adds a level of complication to the intervention that should be carefully considered.

Beyond subject and program characteristics, researchers need to decide on method characteristics – that is, the study design. The design of the study determines not only the practical implications of running the study, but also the review the study will receive in the research community. Mercer, DeVinney, Fine, Green, and Dougherty (2007) provide a succinct summary of the options and associated costs and benefits (adapted from Mercer et al., 2007 – see also Table 1 reproduced from Mercer et al., 2007).

Randomized controlled designs (RCT) are the gold standard for intervention studies. In an RCT individuals are randomly assigned to a treatment group. For instance, half the children in a school would receive an intervention while the other half would not. Membership is determined randomly so that each teen has a 50/50 chance of being in the treatment condition. The RCT is the gold standard because the random nature of group assignments protect the study against any biases that may confound results. For instance, if 12-14 year olds were assigned to a treatment condition and 15-18 year olds were assigned to a control groups (not receiving intervention), the effect of the intervention would be hard to estimate given that age was not matched between the two groups. In such a study, age and developmental issues will confound findings.

A *randomized encouragement trial (RET)* retains the benefits of randomization while simultaneously mimicking the delivery of many preventive services in real-world settings by encouraging subjects in the intervention group to participate in the intervention or to choose among a menu of specifically defined intervention options, while subjects in the control group are neither offered nor encouraged to participate in the intervention. With this design, support from community leaders may be greater because participants are given choice, and encouragement strategies can be developed collaboratively with the community. Given that real-world aspects are mimicked, the RET has less validity than the RCT, but higher than an observational or quasi-experimental study (see below). However, compared to an RCT a well-executed RET may have stronger external validity than a traditional RCT with random assignment, while also providing an indication of the uptake or participation rate among participants.

A *staggered enrollment trial (SET)* (which is also a type of RCT) begins by randomizing subjects into the intervention or control arm for a finite period of time. During this period, the trial design is the same as that of a traditional RCT. At the end of this first follow-up period, the initial control subjects are either started on the intervention (similar to wait-list controls) or randomized a second time to intervention or control, with all subjects eventually participating in the intervention. In the former case, the comparison for the control subjects now in the intervention is the time when they were in the control group. In the latter case, the comparison for the intervention subjects is the subjects who remain in the control arm. The advantage of the SET is that subjects know that they will be enrolled in the treatment at some point in the study. It therefore has lower attrition rates. The disadvantage is that no control is provided for longer term outcomes because all participants receive the intervention.

A *group randomized trial* (GRT) is another type of RCT designed specifically for groups such as schools or communities. The main advantage of the GRT is that potential sources of bias are equally distributed across intervention and control groups and, assuming a valid analysis, inferences can be as strong as those obtained from a traditional RCT with individual random assignment. Intervention and control groups need to be matched on several stable independent correlates of the outcome such as age or problem severity, or to be similar on such correlates if the number of groups is large enough. Non-comparability of groups and the requirement of large samples are drawbacks for GRT.

A *pre-post* (PP) design is nonrandomized and therefore quasi-experimental. It follows a simple pre-and post-intervention test design. With no control groups, the internal and external limitations are obvious. However, such designs may be useful for early pilot feasibility studies.

In an *interrupted time series* (ITS) design, a sequence of consecutive observations is interrupted by the intervention to see if the slope or level of the sequence changes following the intervention. A site therefore acts as its own comparison prior to implementation. ITS is a good alternative when randomization is not feasible. The *multiple baseline* (MB) design is a form of ITS design that is used most often when components of interventions are being developed or combinations of components within effective interventions are being tested. A “component-oriented” approach involves consecutively adding components to the intervention until the desired effect is achieved.

In a *regression discontinuity* (RD) design, participants (individuals or groups) are assigned to intervention and comparison or control conditions based on their exceeding or falling below a cut-off on an assignment variable, rather than randomly. When an intervention effect is seen, the regression line for the intervention group is discontinuous from the regression line for the comparison or control group. The major strength of RD is that, when properly implemented and analyzed, RD yields an unbiased estimate of the intervention effect.

Clearly, deciding on a study design for an intervention determines the type of intervention that will be delivered, as well as its scientific rigor. Additional decisions in designing an intervention study include a decision on which variables will be measured as *outcomes*. That is, which variables does the intervention seek to reduce or change? These may include reduced behavior (e.g. reduced smoking), more adaptive cognitions or emotions, or variables beyond target variables (school functioning, cognitive functioning, peer relationships, etc). When deciding on measurable outcomes for the intervention the *source of outcome measure* needs to be decided. For instance, teachers or parents may complete questionnaires on teens’ behaviors, or teens themselves may report on changes in their behavior, thoughts or feelings. Peer-report, review of records or observations may provide more objective measurements of outcomes. The last decision that intervention researchers are required to make is the period of *follow-up*. Most interventions aim for sustained effects. To demonstrate this, a follow-up component should be included in the study. These tend to be expensive and may be associated with large attrition (drop-out) rates, so should be considered carefully.

IV. Multiple component programs as the way forward

Given the complexities of first identifying targets for intervention and subsequently designing intervention studies, it is hard to summarize what works for whom. The type of intervention study most often attempted has been, not surprisingly, primary prevention school-based programs for reducing gateway substance use (alcohol, cigarettes, and marijuana) and have been tested in community-based trials (Botvin & Griffin, 1999; Hansen, 1992; Bangert-Drowns, 1988; Tobler & Stratton, 1997). In an attempt to summarize what works for whom, we have drawn on this literature to identify the characteristics of most programs. In so doing, we have found that most successful research-based approaches have been derived from psychosocial theories of the development of drug abuse that incorporate *both* protective and risk factors associated with the initiation and early stages of drug use (Hawkins, Catalano & Miller, 1992; Petraitis, Flay & Miller, 1995) and programs have a multi-component design (Hall, Jamieson, & Romer, 2003). In summary, effective interventions tend to focus on (1) social resistance training (*how to say no*), (2) normative education (showing adolescents that they overestimate the prevalence of drug use among peers and adults by providing them with actual rates of use) (3) competence enhancement (social connectedness, personal and active coping skills to “unlearn” the effects of modeling, imitation and reinforcement that have brought about the risk taking behavior) (4) some combination of the above (Griffin, 2003).

Indeed, simply telling teens that behavior is risky will not be a successful strategy on its own (Hall, Jamieson & Romer, 2003). Thus, multicomponent programs for drug use prevention have been shown to be most effective for the following reasons (Griffin, 2003): (1) Social resistance programs (just say no!) are ineffective in communities where liberal social norms regarding drug use exist; therefore, students need more than the skill to just say no; (2) social resistance alone is likely to be ineffective in adolescents who are already prone to risk taking, given that some risk-taking in adolescence is normative; (3) competence enhancement without drug content is difficult to translate into drug-related situations, so needs to be done in the context of drug related issues; (4) because addiction has multiple etiological pathways one approach is likely to have limited success.

We now turn to the issue of adolescent problem gambling, which is a latecomer to adolescent risk behavior research. Valuable lessons can be learnt from the track record of primary prevention programs in reducing substance use among teens as we embark on our own journey to better understand and prevent problem gambling among youth.

V. Adolescent problem gambling

Adolescent gambling is increasingly being perceived as a significant problem (Griffiths, 2003). Like other high-risk behaviors in teens, problem gambling appears to co-occur with other problem behaviors such as illicit drug and alcohol abuse (Giacopassi, Stitt & Vandiver, 1998; Griffiths, & Sutherland, 1998; Gupta & Derevensky, 1998; Stinchfield, Cassuto, Winters & Latimer, 1997; Proimos, DuRant, Pierce & Goodman, 1998) and delinquency (Winters, Stinchfield & Fulkerson, 1993). Using a classification paradigm that was dominant until recently, Steinberg (1988) estimated that about 4-8% of US high school students could be classified as pathological gamblers, with similar rates in Canada and the United Kingdom. This was twice the rate identified using the same paradigm for adults (Griffiths, 1995). However, in their review of prevalence studies of problem gambling in youth Derevensky, Gupta and Winters (2003) suggested that these prevalence rates are inflated, and called for more rigorous research, including the need for the development and refinement of current adolescent instruments and screening tools, agreement upon a gold standard criterion for adolescent problem gambling, and clarity of nomenclature (classification) issues.

Male gender (Griffiths, 1991; Stinchfield, 2000) and parental gambling (Browne & Brown, 1994) appear to be associated risk factors, as well as working-class youth culture, poor school performance, theft, truancy, early onset of gambling, big win earlier in gambling careers, consistently chasing losses, depression, excitement and arousal during gambling, irrationality during gambling, peer gambling and low self esteem (Fisher, 1993; Griffiths, 1994, 1995, 2003; Winters et al, 1993; Yeoman & Griffiths, 1996).

In the US the most common gambling activities that adolescents engage in include lottery gambling, scratchcard gambling and slot machines. According to Korn (2002) the goals of youth gambling intervention include prevention of gambling-related problems, promotion of informed, balanced attitudes and choices and the protection of vulnerable groups. Thus, a good start is giving teens some facts about gambling as these may be unknown to them (Ferland, Ladouceur & Vitaro, 2002). However as have been discussed above, decades of intervention research for other risky teen behavior have suggested that more is needed.

As a model, substance abuse interventions (Evans & Gertz, 2003) or alcohol prevention (Potenza, 2003) can be seen as a framework for developing interventions. However, few teen gambling interventions have been developed or evaluated to date. This is partly accounted for by the fact that the "Stage 1" requirements for prevention science described above has not been met for youth gambling problems; that is, the major correlates and predictors of youth gambling problems remain largely unknown. Nevertheless, Gaboury and Ladouceur (1993) implemented a prevention program with 289 high school students focusing on delivering information about gambling. The intervention led to improved knowledge about gambling and to more realistic attitudes toward gambling and reduced gambling problems. Given the shortcomings of "knowledge based" studies discussed earlier, Ferland et al. (2002) designed a study to correct misconceptions and increase knowledge about gambling in 424 adolescents using a video format which proved to have positive effects. No studies, to our knowledge, have included all three components (social resistance or social inoculation; normative education; competence enhancement).

For any gambling intervention to be successful it will have to be theory driven, with clearly defined subject characteristics and outcome variables (see Section IV above) (Derevensky, Gupta, Dickson, Hardoon & Deguire, 2003). Clearly, indirect interventions may also be useful. For example, in a survey of high school and college administrators in Massachusetts, only 9% of high school and community college administrators were aware of gambling problems among their students; few reported an awareness of state gambling prevention initiatives for student athletes, and only 33% reported an interest in incorporating gambling-related issues into their curricula (Shaffer, Forman, Scanlan, & Smith, 2000). The high comorbidity of problem gambling with other risky behaviors suggests a need for increased intervention (Petry & Zeena, 2001). Screening for gambling in family, school and medical settings warrants further consideration (Potenza, 2003).

PART II: THE SOUTH AFRICAN CONTEXT

I. Risk behaviour among South African adolescents

Like their Western counterparts South African adolescents frequently engage in a range of high-risk activities. Evidence from a number of local studies reveals that our youth use alcohol, tobacco and other drugs, engage in unprotected sex, have unhealthy dietary behaviours and are both perpetrators and victims of violence (Burnett, 1998; Department of Health, 1998; Filsher, Reddy, Muller & Lombard, 2003; Frantz, Phillips & Amosun, 2000; James, Reddy, Taylor & Jinabhai, 2002; Jewkes, Levin, Loveday & Kekana, 2003; Jinabhai et al., 2001; Madu & Matla, 2003; Monyeki, Cameroon & Getz, 2000; Morojele, et al., 2002; Panday, Reddy, & Bergstrom, 2002; Parry et al., 1997; Reddy, James, McCauley, 2003; Swart, Reddy, Pitt, Panday, 2001; Swart, Reddy, Ruiters, de Vries, 2002; Swart, Seedat, Stevens, Ricardo, 2002). Recently, a nationally representative survey of risk behaviour among South African secondary school learners (grades 8 through 11) provided detailed prevalence estimates on these and other key risk behaviours (Reddy et al., 2003). Using an adapted measure developed by the Centers for Disease Control and Prevention (CDC) in the United States [the 'Youth Risk Behaviour Surveillance System' (YRBSS)], this survey examined intentional and unintentional injuries, violence and traffic safety, suicide-related behaviours, behaviours related to substance abuse (tobacco, alcohol and other drugs), sexual behaviour, nutrition and dietary behaviours, physical activity and hygiene related behaviours (Reddy et al., 2003). While in many respects the broad profile of risk behaviour among South African adolescents appears to be similar to that reported in other countries throughout the world (e.g., Darroch, Singh & Frost, 2001; Singh, Wulf, Samara & Cuca, 2000), a number of factors uniquely complicate the South African scenario.

Firstly, although some years have passed since the move to a democratic government, South Africa remains a country in a state of rapid political, social, demographic and economic transition. Our youth, directly affected by changes such as the introduction of compulsory schooling, find themselves having to adapt to new opportunities and cope with new challenges. Consideration of risk behaviour among South African adolescents must therefore contend with the wider context of transition.

Secondly, among adolescents there are considerable and significant variations across age, gender, grade, 'race'¹ and province for each of the risk behaviours that have been investigated thus far (Reddy et al., 2003). While group differences are not uncommon in the wider risk literature, given extensive historical inequalities in the provision of services in South Africa, existing group asymmetries are especially difficult to interpret. The most obviously challenging of these are 'race' comparisons, since service inequalities were perpetuated along 'racial' lines. However other, seemingly straightforward comparisons can also be problematic. Thus for example, reported differences by grade may be complicated by age variance common among classes of previously disadvantaged learners. Indeed, wide age variance itself may be a factor in risk and risk behaviour (Kupp et al, 2008). Similarly, area comparisons are complicated by the fact that the South African population remains geopolitically uneven. We should not, however, dismiss available group comparisons out of hand. Unlike in the developed world, the epidemiological context in South Africa dramatically increases the consequences of adolescent risk behaviour. In this respect, from the perspective of public health, it would be negligent to ignore the differences in risk profiles proxied by group designations.

Thus for example, the HIV/AIDS pandemic in sub-Saharan Africa and South Africa in particular has reached staggering proportions, especially among adolescents (Shisana et al., 2005). Current estimates suggest that nearly half of *all new* cases of HIV occur among under 25's (UNAIDS, 2006). However, there are substantial differences in HIV/AIDS prevalence among 'racial' groups, with prevalence among black South Africans being 13.3% compared to 2.0% in the remainder of the population (Shisana et al., 2005). In South Africa, causal sex, multiple concurrent partners and less than regular condom use are known to be common sexual risk practices among adolescents (Simbayi, Chaubeau & Shisana, 2004). Again, however such practices vary significantly by 'racial' group. Thus in the 2002 risk survey mentioned above significantly fewer white learners (25.9%) reported ever having had sex compared to black learners (43.6%) and significantly more white (49.8%) and coloured learners (39.5%) than black learners (26.9%) reported using condoms consistently (Reddy et al., 2003). In addition sexual debut was significantly earlier (less than 14 years) among black (15.6%) and coloured (12.0%) than white (6.4%) groups. Sexually transmitted infections (STIs) acquired through unsafe sexual practices are also associated with increased risk of acquiring HIV and with increased infectivity of an individual to sexual partners (Colvin, 2000). Again group variations are known to exist with significantly fewer white (1.2%) and coloured learners (3.2%) who have had sex reporting having had an STI compared to black learners (7.7%) who have had sex (Reddy et al. 2003). Apart from STIs, over 13 million adolescents in the developing world have unintended births each year (Alan Guttmacher Institute, 1998). Among

¹ Reddy et al. (2003) point out that while not endorsing racial classifications as introduced by the Population Registration Act of 1950, their data is nevertheless reported by 'racial' divisions in order to redress the inequalities introduced during the apartheid years.

South African adolescents 16.4% have made someone pregnant or have themselves been pregnant, and 8.1% have undergone an abortion or had a partner who did (Reddy et al. 2003). Again, though, prevalence estimates varied by nearly double by group designation. Sexual risk taking among South African adolescents therefore presents both a serious and highly heterogeneous threat to public health. We might expect similar differences across other forms of risk behaviour.

Indeed, adolescents in South Africa also face specific though interrelated threats from drugs, alcohol and violence. One in eight high school students begin drinking before they are 13-years old, and nearly 25% of students in grades 8 to 11 admit to binge drinking in the previous month. Although slightly less common, cigarette and marijuana use is also evident, with 21% admitting to having smoked cigarettes in the past month, and approximately 7% having done so on 20 or more days. 13% reported trying marijuana, with the majority of these having used it in the past month (Reddy et al., 2003). Smith et al. (2008) point out that these rates, like those for sexual behaviour (see Singh et al. 2000), are not dissimilar to those found in USA and other countries, and have the same associated public health consequences, including accidental death and injury (especially due to motor vehicle and pedestrian accidents), self-harm and violence (Reddy et al., 2003). However in addition to these concerns, the link between sexual risk taking and substance abuse distinguishes this risk behaviour in public health terms for the South African context.

In this respect, a growing body of research supports the clustering of substance abuse and sexual risk taking. For example, among adolescents, tobacco, alcohol and other drugs continue to emerge as risk factors for sexual behavior, use of contraception, and teen pregnancy (Kirby, 2001). Guo et al. (2002) recently concluded that to prevent risky sexual behavior among young adults, interventions should focus on binge drinking and marijuana use. In South African samples, Taylor et al. (2003) found that high school students in KwaZulu-Natal who used alcohol or smoked cigarettes were two to three times more likely to be sexually active. In Cape Town, Flisher et al. (1996) found that youth who had initiated sexual intercourse were more likely to be current smokers, recent binge drinkers, and lifetime marijuana users (see also Palen et al., 2006, Simbayi et al., 2005). Although the evidence for a causal relationship is not conclusive (i.e., it may be that the different risk behaviours share the same underlying constituents; Romer, 2003), the most prudent public health approach appears to be to target risk factors in relation to one other. Again, for South African adolescents, the higher prevalence of HIV substantially increases the health risks of unsafe sexual behavior whether related to substance abuse or not. This fact alone has gone some way towards activating the public health response within South Africa.

Indeed for some time, the majority of evidence-based prevention interventions aimed at reducing risk behaviour and promoting health among adolescents have been designed, implemented and evaluated in North America, Europe and Australia (Wegner, Flisher, Caldwell, Vergnani, & Smith, 2007). Recently however, interventions designed to prevent the spread of HIV by targeting associated adolescent risk behaviour have received much local and international attention. In addition the new South African government has been eager to address public health issues affecting youth, especially among previously disadvantaged populations, where multi-level factors (personal, interpersonal, environmental) combine to compound vulnerability (Blum, McNeely & Nonnemaker, 2002). To this end, local governments have gradually implemented now mandatory (since 2001) 'life skills' curricula in classrooms throughout the country (see for example, The Life Skills and HIV / AIDS Education Programme; Department of Education and culture, KwaZulu-Natal, 2000).

The last 10 years have seen an extensive concentration of more or less rigorous attempts to influence risk behaviour among adolescents. For the most part these attempts have taken the form of school-based intervention programmes. These are seen as among the most cost-effective approaches to health in developing countries (World Bank, 1993). In addition to affording a respected platform to deliver comprehensive programmes to the majority of adolescents, school based programmes also circumvent the common normative constraints on open discussion between adults and teenagers (Gilbert & Walker, 2002). The merits of such programmes, however, extend only as far their efficacy. In this respect while the last 10 years have also seen a corresponding increase in scientific studies designed to examine the effectiveness of South African programmes, the available literature remains limited (see Table 2).

There is, however, growing interest in improving intervention studies in South Africa and Africa more widely as evidenced by a number of recent reviews (e.g., Kaaya, Mukoma, Flisher & Klepp, 2002; Kirby, Laris, & Rolleri, 2007; Paul-Ebhohimhen, Poobalan & van Teijlingen, 2008; Speizer, Magnani & Colvin, 2003). Such reviews concern themselves mostly with 'what works' in the context of risk behaviour and HIV/AIDS. While this is understandable, we may also want to step back a little. That is, existing studies, in addition to providing useful information about intervention efficacy in specific domains, also provide valuable insights relevant to the design, implementation and evaluation of risk behaviour interventions in general. Although the majority of available programmes and assessments are essentially adapted western imports, much can still be learned from them. In particular these studies not only foreground the principles of good intervention science, but also catalogue the challenges specific to applying this science to South Africa's unique context.

II. Methods

Search Strategy

We used specific search terms to search electronic databases (PsychINFO, African Wide:Nipad, SAepublications), specific journals (Addiction, Journal of Child and Adolescent Mental Health, Journal of Adolescence) and other research resources (Index of Scientific and Technical Proceedings, Conference papers index, Dissertation abstracts). We also conducted electronic searches of leading authors who have published in the field, and hand searched reference lists from the articles sourced.

Search terms included: [Intervention OR School-based intervention] AND (South African) AND (Adolescent OR Youth) AND (Risk OR Addiction OR Abuse OR Sensation Seeking). [Intervention AND (Adolescent OR Adolescents OR Youth) AND (Smoking OR Drug/s OR Alcohol OR Gambling OR Glue OR Inhalants OR High-risk sexual behavior OR HIV/AIDS OR STDs OR Condoms OR Pregnancy OR Pornography OR Sexual Bartering OR Sexual Exchange OR Sugar daddy OR Transactional sex OR Prostitution OR Diet OR Vomiting OR Exercise OR Driving OR Aggression OR Bullying OR Fighting OR Violence OR Assault OR Crime OR Theft OR Weapons OR Truancy OR Train surfing OR Dares OR Self Harm OR Cutting).]

Selection criteria

Type of studies. School-based interventions focused on high-risk behaviors among South African adolescents published between 1994 and 2008. Types of participant. Adolescents (aged 13 to 18 years) in school settings. Types of interventions. Classroom programmes or curricula, including those with associated family and community interventions, intended to prevent or reduce high-risk behavior. There was no preference for specific theoretical orientations, programme content or targeted risk behavior. Types of outcomes measures. There was no preference for any specific types of outcome measures.

Data collection and analysis

We conducted a narrative review of recent South African school-based intervention studies.

III. Results and discussion

Overview

We identified 9 school-based risk intervention studies in South Africa in the last 15 years, 6 of which were randomized control trials (see Table 2). The latter were conducted by three separate research groups (designated by multiple PI representation across more than one study). One group (Bell et al., 2008; Cupp et al., 2008, Karnell et al., 2006) conducted 3 of the RCTs, 2 of which concerned the same programme ('Our times, Our choices'). The other two groups (James et al., 2005; James et al., 2006 and Smith et al. 2008) conducted 2 and 1 of the RCTs respectively. Studies differed widely in terms of the content and theoretical background that informed the intervention, as well as the extent of formative research carried out (see Table 3). In what follows, we report on these studies across several dimensions salient to intervention science in South Africa.

Targeted risk behavior

All 9 studies targeted sexual risk behaviour, 7 of which did so exclusively. Of the 3 studies that focused on behaviour other than sexual risk taking, 2 focused on alcohol only, while 1 also focused on the use of other drugs (marijuana, cigarette smoking). While the density of research on sexual risk taking is steadily increasing, clearly more research is needed on other adolescent risk behaviors. Drug and alcohol use are obvious candidates for future research. However, the complete omission of high quality intervention studies on violence and aggression, as well as on gambling and other chance behaviour such as dares is a significant gap. In addition, given evidence for the clustering and interrelation of risk behaviour in adolescence, we might expect targeted interventions to impact on multiple domains. Examining potential spill-over effects between for example, gambling interventions and sexual risk taking and alcohol abuse would be a valuable addition to this literature.

Methodological considerations

Six studies included in the review met criteria for good methodological design as described in Part I of this report (i.e., random assignment to control and intervention conditions). Such assignment took place at the school-level to prevent contamination across conditions. While necessary with this form of intervention, school-level randomization may introduce potential confounds because of systematic differences between comparison schools. This is especially true in a South African context where a history of racial segregation and differential allocation of educational resources has grouped students in public schools on a number of school (e.g., teachers education, classroom size, teaching material) and family-level variables (e.g., socioeconomic status, household size, parental education). These variables might themselves be expected to predict differences in risk behaviour. The RCTs reviewed here all attempted to control for such differences by matching comparison schools on relevant background variables. Despite this at least two studies found systematic differences (Karnell et al. 2006, Smith et al. 2008) on baseline risk indicators, without corresponding differences in recorded background variables. Future school-based intervention studies would thus do well to anticipate and measure a wider range of such variables, in order to appropriately control for potential confounding at the school level.

In addition to the RCTs, one of the studies reviewed here used detailed statistical modeling, a large sample, and a panel design to improve methodological rigor (Magnani et al., 2005). This approach was necessary because all subjects had already been exposed to the intervention of interest (the DOE life skills programme), and therefore only dose-response relationships could be examined. Even in a standard RCT, this approach may be of value for long-term follow-up work, especially where an intent-to-treat design is employed. Indeed this is usually thought appropriate in low resource settings and a number of the reviewed interventions employed this model.

Sample size varied from 200 to over 1000 per group, with an average comparison group size of around 400. Sample attrition, even in long-term follow-ups was fairly small with at most 20% drop out. One of the benefits of school-based programmes appears to be the relative stability of the sample over the school years, even in poorer schools. Indeed most of the studies initiated interventions at middle high school age (13 – 15 years old). That said, longer-term follow-ups (i.e., for children near school leaving age) in poorer South African schools can present challenges. For example, Cupp et al. (2008) found that students who remained in their study reported less risky behaviour at baseline. Systematic differences in participants who drop out could thus inflate the efficacy of interventions, suggesting that every effort should be made to track students beyond the school environment. In addition, there was often wide age variance in studies targeting specific grades. Such variance, again a historical feature of poorer non-white samples in South Africa, might be considered in the design of intervention materials. This may be particularly relevant where such materials rely on group activities, or where older students are known to exert influence as opinion leaders.

Two studies included brief interventions, one with a once-off exposure to course content (James et al., 2005) and the other with a two-week school wide thematic focus (Kuhn et al., 1994). The majority of studies though used a repeated class lesson format ranging in exposure from 8 to 20 weeks (excluding self-reported class exposure in Magnani et al., 2005). Follow-up periods ranged from immediately after an intervention, to 5 years, with a good proportion of studies conducting 6 month to 1-year follow-ups. Given the possibility of decay in intervention effects over time, as well as the possibility of short run increases in risk behaviour following content exposure, the inclusion of longer term follow-up is critical in establishing intervention efficacy. Most of the South African studies reviewed here echoed this point, and one (Smith et al. 2008) specifically in the context of discovered increases in risk behaviour following an intervention.

Intervention Efficacy

Despite what appear to be some high quality interventions, the record of success in shifting adolescent risk behaviour appears to be limited. Although the majority of studies have recorded improvements in knowledge, attitudes and to a lesser extent intentions, evidence of actual behavioural change is limited. Similarly, studies have found very little evidence for increases in awareness of personal susceptibility. In addition to knowledge and attitudes, targeting risk interventions to more directly influence behavioral skills, psychological variables like susceptibility would appear to be crucial (Bell et al. 2008; Cupp et al., 2008; James et al., 2005; James et al., 2006).

The efficacy of results in South African samples is also challenged by the generalizability of extant findings. Without improving sample diversity by, for example, multi-province multi-site sampling, differences by racial classification cannot be examined. This is problematic because despite changes in South African society, race remains a central factor in health outcomes. For example, black adolescents are at highest risk for HIV, yet a number of the positive behavioral findings in the study for sexual risk behaviour have come from a mixed race sample in Cape Town (Smith et al., 2008). In the context of gambling, unpublished South African prevalence data (by the present authors and colleagues at the University of Cape Town) suggest that young black males living in areas dominated by the mining industry are at highest risk. An intervention study, which did not address this population directly, would thus be of limited value in the South African context.

Theory and Programmes

Five of the 9 studies reviewed included some discussion of the theoretical content informing their specific intervention. The majority of these were international programmes adapted for South African use. Of the 4 that did not include theoretical background information, 2 were government programmes. Another was an assessment of a locally developed and popular photo-novella (James et al. 2005) while the fourth was an early awareness campaign (Kuhn et al. 1994). Although the necessity of evaluating locally developed and preexisting programme material is understandable, the lack of science informing locally developed content is problematic. There is no reason why existing and new programme content, developed in South Africa, cannot draw on the wealth of theoretical and empirical information available from elsewhere. Indeed, because of the apparent nesting of adolescent risk behaviour, many of the features of existing programmes focused on, for example, risky sexual behaviour, alcohol and drug abuse will be directly relevant in the design of gambling interventions.

Although a discussion of the theory underpinning each of the reviewed programmes is outside the scope of this review, a number of salient features emerge. Theoretically informed programmes went to some length to contextualize course material to local environmental and social conditions through formal or informal process evaluation (see below). These programmes also used multimodal delivery methods (e.g., graphic material, enactments, role plays), and placed a strong emphasis on the development of 'skills' as well as knowledge. The use of peer educators/leaders in delivery, as well as involving family/caregivers in a community collaborative approach was also emphasized. In addition, one study by Smith et al. (2008) included a strong focus on the positive use of leisure time, a promising and often overlooked approach in the context of adolescent risk.

Formative research/ Process evaluation

Three of the 9 studies included multiple publications on formative research, and 1 of the 9 served as a pilot study (Karnell et al 2006). Another research group is in the process of developing a large-scale adolescent intervention in South Africa (and other African countries) and has already published several papers on their formative research (e.g., Aarø et al., 2006). This scientifically credible approach, with reliance on imported programmes, is promising, and should be modeled in the design of future risk interventions. Bell et al. (2008), for example, were able to introduce important content around stigma into their intervention based on formative work with the target population. Similarly work by Karnell et al. (2006) led them to suggest that future research in South Africa should, at minimum, assess the extent to which individuals follow more traditional indigenous spiritual and/or Western spiritual or religious ideologies. In the context of thinking about unpredictable contingencies, such assessments may be crucial. Indeed, investigating cultural expectations and group norms and values (as well as sub-cultural differences) surrounding the behaviour of interest would appear to be a necessary first step for any intervention programme.

In addition to formative research, all the studies reviewed included process evaluations. Such evaluations, typically involved student and teacher feedback, allowed for the future adaptation and development of materials as well as highlighting the specific challenges encountered. In some cases monitoring the delivery of the material ("fidelity" discussed in Section II of this report) also served as an important variable of interest. For example, while intervention versus control groups in James et al. (2006) showed only small differences in knowledge, process evaluation showed that teachers implemented the programme to varying extents (full vs. partial implementation). Interestingly, on the basis of an analysis of constructed exposure groups a number of intervention effects were then revealed. Careful monitoring of the time spent on the lessons, the number of lessons carried out, the content covered and the didactic style (fact based rather than skill-based) are thus important considerations for monitoring future interventions.

On a related point, as discussed in Section II of this report, collaborative and respectful working relationships between researchers and community interventionists are crucial. Reliance on schoolteachers, and in a number of cases peer leaders, for both the development and delivery of material, is necessary to ensure appropriate content and increase participant motivation. However, as Kuhn et al. (1994) have reported, teachers initially supportive of a project may come to both resist and lack the confidence to take responsibility for the design and delivery of a programme (see also James et al. 2006). Teachers may also feel the need to express their own moral judgments in the delivery of sensitive material (Visser al. 1995). In this respect researchers jointly advise that realistic expectations are needed about the degree of motivation and potential for different groups to contribute. Certainly, ensuring recruitment of enthusiastic intervention leaders, who are given appropriate training and resources, is critical if intervention content is to have any chance of success (see e.g., Bell et al. 2008), as is a good relationship and history of research and service in the target community (e.g., Smith et al. 2008).

A number of studies also went to some length to ensure that false expectations of service delivery were not created. Failing to attend to this can dramatically reduce subject compliance and jade communities to future interventions. As occurred with the Kuhn et al. (1994) study, interventions in a South African context may also have unintended social consequences, as when communities not made fully aware of the nature of the intervention may come to frame the intervention as negative or indicative of specific problems in a local school. Again, community involvement (e.g., town meetings, parent meetings, meetings with nearby schools not included in the study) from the initiation of a project may go some way toward countering such challenges.

Another limitation highlighted by process evaluation concerned the use of limited self-report formats as well as the frequent absence of reliable biomedical measures. In the context of gambling research the latter may not be directly relevant (except insofar as spill-over effects may be of interest). However, the need for improvements to self-report measures was commonly reported (e.g., Bell et al. 2008; Cupp et al., 2008, Karnell et al., 2006). Such improvements include the local adaptation and validation of measures as well as ensuring privacy for adolescents when giving personal information. Bell et al. (2008) addressed the latter concerns through the use of PDAs, which also had headphone attachments to ensure respondent comprehension of questions.

PART III: SUMMARY AND CONCLUSIONS

The aim of the current report was to summarize the literature on the intervention against high-risk behaviors in teens so as to facilitate the design and evaluation of intervention programmes in South Africa. To this end, we organized and reviewed material in two parts. In Part I, Section I, we presented a general overview of the international literature on interventions for high-risk teens, with a specific focus on school-based interventions. We began by dispelling general myths regarding high-risk behavior in teens and reviewing research on the most salient correlates and predictors of high-risk behavior. We discussed how the focus of research has moved from exclusively focusing on cognitive (decision-making) factors to now include emotional factors, with the most recent wave of research focusing on school connectedness as a protective factor in the development of high-risk teen behavior (Section II).

In Section III we discussed the principles of intervention science in developmental psychopathology. We discussed how intervention science starts with determining adequate targets for treatment for each particular risk taking behavior, after which efficacy (laboratory) and effectiveness (real-world) studies are conducted. Several scientific approaches, from experimental to quasi-experimental, were discussed for carrying out intervention research. We furthermore outlined the complex decision-making process researchers engage in when designing an intervention study. These include decisions about the target population (subject characteristics), program content, study design, outcomes and follow-up strategy.

In Section IV we used substance use interventions as models for guiding a discussion of the characteristics of intervention programs that appear to be most successful. Given the overlap in risk-taking behavior and shared correlates amongst risky behavior, we justified multiple component interventions that target several correlates at once, as the way of the future. We also emphasized that knowledge-based programmes alone are not sufficient to adequately address risk-taking behavior in adolescents. We completed Part I with a review of intervention literature on adolescent problem gambling, as problem gambling constitutes the main focus of the research work funded by the South African Responsible Gambling Foundation. In that discussion it became clear that very little is known about the unique correlates of gambling disorder in adolescents, raising the question whether such research should be conducted first before effective interventions may be designed, especially against the background of literature demonstrating that interventions carried out in a theoretical vacuum are likely to fail.

In Part II, we took a closer look at South African-specific challenges in applying interventions science. We conducted a narrative review of South African school based interventions focused on preventing or reducing high-risk behavior among adolescents (13 -18) in the last 15 years (1994 – 2009). Our aim here was to distill generic principles that may guide the development and implementation of adolescent risk behaviour interventions in South Africa. The review of South African intervention studies suggest that if adolescents are to overcome the lure of 'sex, drugs and dice to roll' they may have to go beyond a traditional focus on knowledge and attitudes. A focus on behavioral skills, mediating psychological variables such as personal susceptibility and additionally targeting family and peer influences, is recommended. As discussed earlier, adolescent risk behaviour involves not only potential harm but also anticipated reward. Adolescents are not naïve to this reality. Effective risk reduction strategies focused on behaviour change would thus also do well to consider engendering attractive but positive alternatives as crucial components of course content.

Against the background of the above summary, we conclude with a set of recommendations for the design and evaluation of intervention programs in South Africa. First, Part I of this report clearly highlights the complexity of designing successful interventions. Therefore, interventions should be designed and evaluated by those with *training and experience in either the educational or psychological sciences*. A preferred sub-specialty in this regard is Prevention Science with a focus on adolescence.

In addition to a background in psychological or educational sciences, interventionists and evaluators thereof should be sensitive to the particular characteristics of the South African context. As such, it is recommended that scientists be recruited who have a *background in conducting research in South Africa*. Socio-political awareness and an awareness of the particular challenges facing researchers are especially important in a multi-cultural and transitioning South Africa.

A third recommendation relates to the multi-component nature of most successful intervention programs. As such, it is important to assemble a *multi-disciplinary team* of researchers and scientists to design and evaluate interventions. Moreover, the scientists evaluating the intervention should be, as much as possible, blind to the design and implementation of the intervention so as to in a position to *independently evaluate* the program.

Relatedly, *clear criteria* need to be formulated by which an intervention should be evaluated. Specifically, as discussed in Part I, Section III, of this report, there are trade-offs between scientific rigor, community need, and practical feasibility of intervention studies. These aspects need to be taken into account in setting the criteria for the evaluation of an intervention. Evaluators should also be made

aware of the *broader aims* within which an intervention study is conducted. For instance, given the long-term programmatic nature of intervention research through multiple stages (see Section III, Part I), a particular intervention study may be evaluated in the context of pilot or preliminary work that may pave the way for future, more rigorous interventions. Such information is crucial to communicate to evaluators so as to place the study within the broader contexts of prevention science.

Taken together, it is clear from this report that the process of evaluating an intervention is nearly as complicated as designing the intervention itself. Ample time should be provided for the evaluation of a newly designed intervention. Ideally, any intervention should be preceded by a pilot study that can be evaluated by independent assessors prior to the intervention study itself. This report may be used as a guide in this process.

Table 1. Strengths and limitations of, and enhancements to, alternative designs discussed at May 4–5, 2004 Symposium for Studying Complex, Multi-Level Health Interventions.

Design	Key Strengths a,b	Key limitations	Enhancements that could strengthen design
True experiments: randomized controlled designs	Gold standard for establishing causation because randomization creates probabilistically equivalent treatment and control groups leading to high internal validity	May have low external validity	Could increase external validity and understanding of process by assessing implementation and sustainability in natural settings
Traditional RCT with individual as unit of RA	Protects against most threats to internal validity: ambiguous temporal precedence, selection, history, maturation, testing, instrumentation, regression to the mean	Could have differential attrition between intervention and control groups May have low external validity	Consider using practical clinical trials ⁵ including attention to (1) selection of clinically relevant alternative interventions for comparison, (2) including diverse study participants, (3) recruiting participants from heterogeneous settings, and (4) collecting data on a broad range of health outcomes Consider relevance of grounded theory by Shadish et al. ³² and apply their principles for achieving generalized causal inference
RET	Stronger external validity than traditional RCT with individuals as the unit of RA and stronger internal validity than observational and quasi-experimental studies RA to encouragement (persuasive communication) to have the intervention or to Select from a menu of options more closely mimics the delivery of preventive services in real-world settings Can reveal participants' decision-making process (i.e., models real-world behavior of treatment choices) Researchers and community are partners in the research; community and individual preferences are considered May provide a more equitable relationship between researcher and participant than mandated treatment assignment	Internal validity may be lower than a traditional RCT with individuals as the unit of RA Need to collect extensive quantitative and qualitative data to measure intensity of and fidelity to implementation of intervention Because it is less controlled than an RCT, RETs tend to have smaller effect sizes and greater within-group variance. Therefore requiring larger sample sizes Cost may be very high due to data collection requirements and smaller effect sizes and greater within-group variance than RCTs	If encouragement strategies are developed collaboratively between researcher and participants, can promote an even more equitable relationship between researcher and participant Can reduce cost if use of an intermediate variable as study endpoint rather than a disease endpoint is defensible

Table 1. Strengths and limitations of, and enhancements to, alternative designs discussed at May 4–5, 2004 Symposium for Studying Complex, Multi-Level Health Interventions. (continued)

Design	Key Strengths a,b	Key limitations	Enhancements that could strengthen design
SET	<p>Subjects can serve as own controls when those originally in the control arm receive the intervention</p> <p>May have greater enrollment and subject retention among controls than a traditional RCT with individual RA because they know they will receive intervention at a definable future point</p> <p>Staggered enrollment can allow some examination of secular trends through having subjects initiate intervention at different times</p>	<p>No controls for longer-term secular trends</p> <p>May have contamination and extended learning effects by controls who were exposed to general ideas of trial</p>	<p>Add a nonequivalent dependent variable</p>
GRT	<p>With proper randomization and enough groups, bias is similar across study conditions</p> <p>Can use a GRT design with a small number of groups for (1) feasibility study or preliminary evidence of effectiveness, and (2) estimating effect or intraclass correlation coefficient without needing causal inference</p>	<p>Extra variation attributable to groups increases standard error of measurement</p> <p>Degrees of freedom are limited with small numbers of groups, reducing the benefits of randomization</p> <p>Complicated logistics</p> <p>Large-scale GRTs can be very expensive</p>	<p>Can decrease variation attributable to groups through adjustment for covariates (reducing the intraclass correlation coefficient) and modeling time</p> <p>Employ more and smaller groups rather than fewer and larger groups</p> <p>Match or stratify groups a priori</p> <p>Include independent evaluation personnel who are blind to conditions</p> <p>Pay particular attention to recruiting representative groups and members</p>

Quasi-experimental designs: nonrandomized designs with or without control

Design	Key Strengths a,b	Key limitations	Enhancements that could strengthen design
PP	<p>May be useful for testing feasibility of an intervention</p> <p>(Nonrandomized) PP with control or comparison group can account for secular trends</p>	<p>PP without control or comparison group: has many threats to internal validity: selection, history, maturation, testing, and instrumentation</p> <p>Limited external validity for other units, settings, variations in treatment, outcome measures</p>	<p>Add control or comparison group</p> <p>Add nonequivalent dependent variable</p>
ITS	<p>Repeated measures enable examination of trends before, during, and after intervention</p> <p>Boosts power to detect change by providing a precise picture of pre- and post-intervention through taking advantage of order and patterns—both observed and expected— over time</p> <p>Pre-intervention series of data points allows for examination of historical trends, threats to internal validity</p> <p>Can closely assess effect size, speed, and maintenance over time</p>	<p>No accounting for concurrent historical trends without control group</p> <p>Instrumentation changes can lead to identification of spurious effect</p> <p>Selection biases if composition of sample changes at intervention</p>	<p>Add control group</p> <p>Qualitatively or quantitatively assess whether other events or changes in composition of sample might have caused effect or whether data collection methods changed</p> <p>Add nonequivalent dependent variables</p> <p>Remove treatment at known time</p> <p>Use switching replications design</p> <p>Use multiple jurisdictions with varying degrees and timing of interventions and similar surveillance data</p>
Multiple Baseline	<p>Each unit acts as its own control</p> <p>All settings can get the intervention if ongoing analyses suggest that it is beneficial</p> <p>Can use individuals and small and large groups as units of analysis</p> <p>Appropriate and accepted statistical analyses exist</p> <p>If an intervention strategy appears, through ongoing analyses, not to be beneficial, that strategy can be modified or replaced by another strategy before the intervention is placed in another jurisdiction/site</p> <p>Can study various components of an intervention individually</p> <p>Design is consistent with decision-making process used by a wide range of influential groups, such as policymakers, police, educators, and health officials</p>	<p>Having fewer study units may limit generalizability</p> <p>Interventions can be affected by chance in some units</p> <p>Measures must be suited for repeated use</p> <p>Must determine how to define a stable baseline</p> <p>The design depends on temporal relationship between intervention and measures that is either abrupt or must be able to predict time lag following intervention</p> <p>Must determine how far apart interventions should be staggered</p>	<p>Increase number of study units</p> <p>Research costs are reduced if data are routinely collected surveillance data</p> <p>Can incorporate switching replication</p> <p>Can randomize within sets of communities to determine order of entry into study</p>

Quasi-experimental designs: nonrandomized designs with or without control (continued)

Design	Key Strengths a,b	Key limitations	Enhancements that could strengthen design
RD	<p>When properly implemented and analyzed, RD yields an unbiased estimate of treatment effect</p> <p>Allows communities to be assigned to treatment based on their need for treatment, which is consistent with how many policies are implemented</p> <p>Incorporates characteristics of multiple designs, including multiple baseline and switching replication</p>	<p>Complex variable specification and statistical analysis</p> <p>Statistical power is considerably less than randomized experiment of same size due to collinearity between assignment and treatment variables</p> <p>Effects are unbiased only if functional form of relationship between assignment variable and outcome variable is correctly specified, including nonlinear relationships and interactions</p>	<p>Correctly model functional form of relationship between assignment and outcome variables prior to treatment.</p> <p>This can be done with surveillance data</p> <p>Power can be enhanced by combining RD with randomized experiment.</p> <p>Rather than using cutoff score for assignment to treatment and control, use cutoff interval. Cases above interval are assigned to treatment and those below are controls. Those within cutoff interval are randomly assigned to treatment or control</p>
NEs	<p>Provide the potential to study more innovative, large-scale, expensive, or hard-to implement programmes and policies than typically can be studied in project funded through regular mechanisms available to funders</p> <p>Provides opportunity to study interventions for which typical funding mechanisms would be too slow to capture such opportunities prospectively</p> <p> Policymakers and laypeople understand NEs</p> <p>Can reduce costs if extant data can be used</p>	<p>Selection biases</p> <p>May have limited generalizability and this is difficult to examine because (1) there is no RA to conditions, (2) matching with comparison groups may be based on limited number of variables; (3) experimenter does not control intervention; and (4) lower internal validity than designs with RA</p>	<p>Can increase internal validity with more data points in the pre- and post-intervention periods, using multiple baseline or time series methods</p>

Table 2.
South African school based intervention studies: Research considerations

Study	Aim	Location/ Sample at baseline	Programme Delivery	Design -Analytic Methods	Months of Observation	Results: Change in Outcome
Bell et al., 2008	Intervention targeting HIV risk behaviors by strengthening family relationship processes, as well as targeting peer influences through enhancing social problem solving and peer negotiation skills for youths.	KwaDedangendiale, KwaZulu Natal. 9 – 13 year-old male and female students (African) 281 intervention and 233 control Random selection of 20 primary schools located within 4 study sites.	SC: School-based HIV prevention curriculum consisting of prevention messages delivered by teachers or health educators. EC: 10 90-minute workshop sessions delivered over 10 weekends by trained community caregivers.	RCT Mixed effects regression model adjusted for nesting within schools.	Baseline and 12-weeks after baseline (94%).	Adult: HIV transmission knowledge +, Less stigma +, Caregiver monitoring 3-Family rules +, Caregiver communication comfort +, Caregiver communication frequency +, Social networks primary +. Child: AIDS transmission knowledge +, less stigma +.
Cupp et al., 2008	Intervention targeting alcohol and HIV risk behaviour among students using elected peer group leaders and character monologues.	Pietermaritzburg, KwaZulu Natal. 13 – 18 year-old male and female 9 th grade students (African). 1095 Randomly chosen 4 intervention and 4 control schools.	SC: Life Orientation instruction and 5 knowledge based units on HIV and Alcohol. EC: 15 30-40 minute units delivered over 8 weeks by trained teachers.	RCT ANOVA and binary logistic regression	Baseline and 4 – 6 months after baseline, and 15 – 18 months following baseline.	Sexual refusal self efficacy +, intentions to have sex +, attitudes about sex +, initiation of sex +, intention to use alcohol with sex +, alcohol refusal self-efficacy +, attitudes about alcohol +.
Smith et al., 2008	Intervention focused on positive use of leisure time, life skills, and sexuality education among students.	Mitchell's Plain, Western Cape. 14 year-old (M) male and female students (80% Mixed race). 901 intervention and 1275 control. Randomly chosen 4 intervention and 5 control schools.	SC: Life Orientation instruction by teachers EC: 12 (2-3)-class lessons in grade 8, followed by 6 booster lessons in grade 9 by trained teachers.	RCT Multiple imputation and logistic regression.	Baseline and 5 waves at 6-month intervals (5 years).	Not sexually active (boys) +, Not sexually active (girls) -, able to get condoms +, less past month drinking +, baseline non-drinkers, less last month (girls) +, less heavy past month use +, less likely initiate smoking & last month smoking (girls) +, baseline non-smokers and sample less last month, less heavy smoking +, initiate marijuana (boys) -, initiate marijuana (girls) +.

Table 2.
South African school based intervention studies: Research considerations (continued)

Study	Aim	Location/ Sample at baseline	Programme Delivery	Design -Analytic Methods	Months of Observation	Results: Change in Outcome
Karnell et al., 2006	Intervention targeting alcohol and HIV risk behaviour among students using elected peer group leaders and character monologues.	Pietermaritzburg, KwaZulu Natal. 16 year-old (Mdn.) male and female 9th grade students (African). 325 intervention and 336 control. Randomly chosen 3 intervention and 2 control schools.	SSC: Life Orientation instruction (few modules concerning alcohol or HIV) by teachers. EC: 10 30-minute units delivered over 8 weeks by trained teachers.	RCT ANOVA, and binary logistic regression.	Baseline and 8-weeks after intervention (81%).	Decrease in reported alcohol use concurrent with sexual intercourse among previously non-sexually active students +, Sex refusal self-efficacy (females) +, intention to use a condom among previously sexually active +, correct answer to question on risk of "many sex partners" among previously non-sexually active +.
James et al., 2006	Intervention focused on HIV and AIDS prevention.	Pietermaritzburg, KwaZulu Natal. 15.5 year-old (M.) male and female 9th grade students. 628 intervention and 513 control (African) Randomly chosen 11 intervention and 11 control schools.	SC: Life Orientation instruction by teachers (no structured HIV lessons, HIV awareness day). EC: 20 1-class sessions delivered over 20 weeks by trained teachers.	RCT Linear mixed model and logistic regression.	Baseline, 6-months after intervention and 10 months after intervention (82%).	HIV knowledge scores at T2 and T3 +.
James et al., 2005	Intervention focusing on prevention of sexually transmitted infections (STIs).	Midlands, KwaZulu Natal 15 – 18 year-old 11th grade students. 569 intervention and 599 control. Randomly chosen 8 intervention and 9 control schools.	SC: Life Orientation instruction by teachers EC: 1 30 minute reading of comic by students	RCT Linear mixed model and logistic regression.	Baseline, 3 weeks after intervention, and 9 weeks after intervention.	Knowledge about spread of STIs +, positive attitude to condom use +, positive attitude to people with HIV (males) +, intention to use condom +.

Table 2.
South African school based intervention studies: Research considerations (continued)

Study	Aim	Location/ Sample at baseline	Programme Delivery	Design -Analytic Methods	Months of Observation	Results: Change in Outcome
Magnani et al., 2005	Intervention focused on HIV and AIDS prevention.	Durban and Mtunzini, KwaZulu Natal 14 – 22 year-old males and females. 3052	EC: Variable in class exposure determined by self-report.	Panel study (no control group, no pretest - dose response relationships). Econometric methods	T1 (1999), 2 years after T1 (83%).	Increased knowledge about sexual and reproductive health, increased perceived condom self-efficacy and condom use at first and last sex.
Visser et al., 1996	Intervention focused on HIV and AIDS prevention.	Provinces throughout South Africa. Grades 8 – 11 (Age range not specified). 339 students (Various populations groups non-representative) Purposeful selecting of 11 accepting schools and 1 randomly selected class per school.	EC: 8-18 school periods by guidance teachers.	Pre and post test T-Tests	Not reported	Knowledge scales +, positive attitudes towards PWA +.
Kuhn et al., 1994	Intervention focused on HIV and AIDS prevention	Western Cape 12 – 30 year-old students (African). 231 intervention and 336 comparison. Purposefully selected intervention school and neighbor comparison school	EC: 2-week programme, various activities, by teachers and parents.	Pre and post tests with comparison group (not randomized)	Not reported	Increase in Knowledge +, increased acceptance of PWA (but generally negative) +, HIV/AIDS communication +, intention to use condom (small) +.

Note: Effect on outcome for intervention group compared to control: significant desirable difference +, significant undesirable difference -. Non-significant comparisons not reported

Table 3.

South African school based intervention studies: Programme Descriptions

Study	Underlying Theory	Original program description	Process Evaluation/ formative research
Bell et al., 2008	The Theory of Triadic Influence (Flay & Petraitis, 1994).	USA Program - <i>Collaborative HIV Adolescent Mental Health Program (CHAMP)</i> - Cartoon based manual designed to increase HIV knowledge and decrease stigma surrounding HIV infections; increase authoritative parenting, caregiver decision-making and caregiver monitoring of children; increase family frequency and comfort discussing hard-to-discuss subjects (e.g., sexuality and risky behaviors); increase connectedness to caregiver social networks; decrease neighborhood disorganization, and increase social control and cohesion.	<p>Adapted to <i>CHAMP South Africa (CHAMPSA)</i>.</p> <p>Published ethnographic research to adapt manual to South African context (Paruk, Petersen, Bhana, et al., 2002; Paruk, Petersen, Bhana, et al., 2005)</p> <p>Published pilot study/formative research (focus groups) to inform content of workshops (Bhana, Petersen, Mason, et al., 2004; Petersen, Mason, Bhana, et al. 2006)</p> <p>Additional risk and protective factors identified - the dynamics of child abuse, stigma, grief from loss (from AIDS), and social capital.</p> <p>Inclusion of community advisory board</p>
Cupp et al., 2008	See Karnell et al. 2006 below	See Karnell et al. 2006 below	See Karnell et al. 2006 below.
Smith et al., 2008	Leisure studies and the family of developmental theories that highlight the role of “multi-directional influences” and “developmental systems”.	USA Programs - <i>TimeWise and HealthWise</i> - Manual covering social-emotional skills (e.g., anxiety and anger management, decision making, self-awareness) the positive use of free time (e.g., beating boredom, overcoming leisure constraints, leisure motivation). Also specific lessons on attitudes, knowledge, and skills surrounding substance use and sexual risk (e.g., relationships and sexual behavior, condom use, realities and myths of drug use).	<p>Adapted to <i>HealthWise and TimeWise South Africa</i>.</p> <p>Published pilot study/formative research (Caldwell et al., 2004, Wegner et al., 2007).</p> <p>Ongoing process evaluations.</p> <p>Inclusion of youth development specialists to serve as liaisons between the schools and the local communities.</p>

Table 3.

South African school based intervention studies: Programme Descriptions (continued)

Study	Underlying Theory	Original program description	Process Evaluation/ formative research
Karnell et al., 2006	Social learning, social inoculation, and cognitive behavior theory.	USA Programs- <i>Project Northland Alcohol Prevention and Reducing the Risk safer sex</i> - Manual and cassette recorded monologues delivered by four fictional teenaged characters, designed to impart key HIV and alcohol related facts, enhance understanding of the consequences of drinking alcohol and having unprotected sex, aid students' identification of positive alternatives to drinking alcohol or having sex, expose students to specific techniques for resisting pressure to drink or have sex, give students the opportunity to practice such techniques through role play exercises, and enhance students' ability to plan ahead to avoid situations in which they would be likely to engage in risk behaviors.	Adapted to <i>Our times, Our choices</i> . No published information on material adaptation, but current study is a pilot for a larger long RTC. Process evaluation included in study, teachers and students response to characters and material, as well as measure. Pilot work reported on design of survey instrument (focus groups).
James et al., 2006	Not stated (the authors criticize the lack of information available concerning empirical or theoretical foundations of the program).	South African program – <i>The Department of Educations' life skills program on HIV and AIDS prevention</i> - Manual based covering facts about HIV and AIDS, especially modes of transmission, the immune system, the progression of HIV to AIDS, and how to keep the body safe and healthy. Also life skills related to the prevention of HIV and AIDS, especially knowledge about HIV and AIDS, attitude to condom use and people living with AIDS, gender norms, and perceptions about sexual behavior.	Process evaluation included in study, focused on programme implementation (number of lessons, topics covered, teaching methodologies and materials used). Full programme implementation revealed increase in knowledge levels of students about the spread and transmission of HIV and AIDS, an increase in perceptions of social support (T3), a reduction in negative perceptions about sexual behavior, a decrease in reported sexual activity and an increase in condom use at T2 (but not T3).
James et al., 2005	Not stated	South African programme - <i>Laduma</i> - Photo-novella or comic strip designed to engender a positive attitude towards safe sexual practices and to enhance self-efficacy and adoption of skills, such as correct condom use, talking about sexually transmitted infections and prevention with partners, negotiating safer sexual practices and decision-making about seeking help. Factual information is provided about sexually transmitted infections, through appropriate responses by a clinic nurse and discussion amongst friends.	Unpublished but authors note material was generated through workshops with youth from Khayalitsha and Guguletu in Cape Town and Kwamashu, Inanda and Thornwood in KZN.

Table 3.

South African school based intervention studies: Programme Descriptions (continued)

Study	Underlying Theory	Original program description	Process Evaluation/ formative research
Magnani et al., 2005	Not stated	South African Programme - <i>The Department of Educations' life skills programme on HIV and AIDS prevention.</i> See James et al., 2006.	Study based on 'dose-response' measured by self-reported exposure to programme content (i.e., analysis counts as process evaluation).
Visser et al., 1996	Bandura's theory of self-efficacy, Health Belief Model and Theory of Reasoned Action	South African Programme – <i>The National Health and Population Development Department - Five modules covering adolescence as a time of change, AIDS and STDs, relationships, life and safe sex skills delivered using interactive learning methods.</i>	Process evaluation included in study, student evaluation, focus groups and interviews with presenters.
Kuhn et al., 1994	Not stated	South African Programme – <i>AIDS Education Programme - Content included: 1) structured classroom based information sessions on AIDS 2) open discussions about AIDS 3) Integration of AIDS content in the language curriculum 4) Interactional education methods 5) Video shows 6) Development of posters, banners by students and their exhibitions in addition to copies of selected media developed elsewhere 7) Slogan competition and distribution of information pamphlets to parents.</i>	Process evaluation included in study, teacher evaluation.

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