

IS THERE EVIDENCE TO SHOW THAT FETAL ALCOHOL SYNDROME CAN BE PREVENTED?*

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ABSTRACT

Fetal Alcohol Syndrome (FAS) is currently the major cause of mental retardation in the Western world. Since FAS is not a natural phenomenon and is created by mixing alcohol and pregnancy, the solution to decreasing the incidence of all alcohol-related birth defects is therefore entirely preventable. To date, little is known about the effectiveness of prevention programs in reducing the incidence of FAS. Therefore, it is the intention of this article to review the effectiveness of prevention programs in lowering the incidence of FAS. The present review revealed that prevention programs, to date, have been successful in raising awareness of FAS levels across the groups examined. However, this awareness has not been translated into behavioral changes in "high risk" drinkers as consumption levels in this group have decreased only marginally, indicating prevention programs have had minimal or no impact in lowering the incidence of FAS. Urgent steps must now be taken to fully test prevention programs, and find new strategies involving both sexes, to reduce and ultimately eliminate the incidence of FAS.

Since the recognition of Fetal Alcohol Syndrome (FAS) in the late 1960s, research has focused mainly on the characteristics and problems associated with FAS. There is no doubt now that maternal alcohol consumption during the conceptual period, and throughout pregnancy, has serious effects on the health of the

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developing embryo and fetus [1-6]. It is also known that the damage to a child born with alcohol-related birth defects, such as FAS and Fetal Alcohol Effects (FAE), is irreversible and permanent. Since FAS and FAE are not natural phenomena and totally created by human beings by mixing alcohol and pregnancy, the solution to decreasing the incidence of all alcohol-related birth defects is entirely preventable. In fact, it is argued that prevention is the only solution to FAS and FAE.

Despite being totally preventable FAS still remains the major cause of mental retardation with a known aetiology in the developed world, surpassing Down's syndrome, cerebral palsy, and spina bifida [7]. In addition, FAS is the third most common cause of congenital defects in newborns [8, 9]. In Australia, a nation with one of the highest alcohol consumption rates in the Western world [10], health authorities acknowledge alcohol consumption as the casual factor in the development of FAS [11].

While there has been sufficient literature examining the characteristics and problems of FAS and FAE, research now needs to expand beyond the interventionist approach and focus more on appropriate preventable measures. To date, little is known about the effectiveness of educative prevention programs in lowering the incidence of FAS and FAE. Therefore, it is the aim of this article to examine the efficacy of prevention programs in FAS and FAE. The present review is divided into two major parts. Part one consists of prevalence and general information on clinical factors of FAS and FAE. This sets the stage for part two which reviews the empirical evidence of prevention programs.

Several criteria were established to select empirically-based studies for inclusion in this review. Only those studies that specifically investigated prevention programs about alcohol use during pregnancy, as opposed to drug use in general, were included. In addition, secondary prevention programs aimed at educating pregnant women of the dangers of alcohol use during pregnancy, were also included. Those studies that related to consumption patterns and reduction of alcohol intake only with pregnant women, were not included as empirical evidence for this had been addressed by other authors [12, 13]

CLINICAL FEATURES OF FAS AND FAE

Children exposed to alcohol consumption in-utero exhibit characteristics which range along a continuum from extremely severe symptoms to milder manifestations. Extensive research findings have established FAS in its most severe form causes lifetime disabilities [4, 5, 8]. The most widely used classification system, the *International Classification of Diseases, Tenth Revision, Clinical Modification* (ICD-10-CM), used for identifying the major characteristics associated with FAS, clusters symptoms into five main areas. These are central nervous system

(CNS) deficits, growth retardation, facial and skeletal abnormalities, behavioral problems, and miscellaneous abnormalities [14, 15]. When children display symptoms in each of these categories a diagnosis of FAS is made.

Mental retardation is the most debilitating and frequently occurring CNS abnormality found in approximately 44 percent of children with FAS [4]. The degree of mental retardation has been linked to the severity of physical abnormalities. In particular, microcephaly (i.e., small head circumference below the third percentile) is related to deficient brain growth [4]. Sensory hypersensitivity in the form of exaggerated responses to the environment also contributes to learning and behavioral problems, eating and sleeping irregularities, and hyperactivity [2].

Growth deficiencies, in both height and weight, are observed in FAS children with many remaining small in size with no significant catch-up growth throughout childhood [15]. Facial anomalies also differentiate infants with FAS from normal children. Narrow forehead, lowset ears, short eye slits, epicanthal folds, short upturned nose, cleft palate, and thin upper lip are the most commonly noted facial malformations. Skeletal deformities affecting fingers, toes, and feet are not uncommon [1].

Miscellaneous abnormalities, such as speech and language deficits, and motor dysfunction demonstrate the variability associated with the diagnosis of FAS. Furthermore, behavioral problems (e.g., attention deficit disorder) are evident throughout childhood with adolescents displaying deviant behaviors uncharacteristic of children with other types of mental retardation (e.g., Down's syndrome) [16].

Children affected by FAE experience some of, but not all, the characteristics associated with FAS. FAE is the single most prevalent cause of cognitive dysfunction [15]. Children with FAE usually display deficits encompassing learning disabilities, hyperactivity with attention deficit, impulsivity, short attention span, and are developmentally delayed in comparison to other children. Despite these problems most children with FAE exhibit intellectual functioning within the normal range [14]. Kleinfeld [17] has noted, undiagnosed children are often labelled as being wilful, difficult, and disruptive in behavior [14]. In addition, a proportion of children with FAE have some of the physical and facial abnormalities characteristic of FAS.

The weight of literature clearly shows that the clinical factors of FAS and FAE are directly related to alcohol consumption [18, 19].

PREVALENCE OF FAS AND FAE

The exact prevalence of FAS is difficult to determine due to the use of different diagnostic criteria by professionals, difficulty in identifying the constellation of features at birth, case finding methodologies, professional under reporting,

and prevalence rates between different population subgroups [20]. A review of medical records, which assessed the usefulness of the ICD-9-CM classification code 760.71 in identifying FAS, found American statistics do not reflect full FAS. Instead, figures tend to only reflect developmental and behavioral problems in children associated with in-utero exposure to alcohol.

Recent conservative estimates based on prospectively collected data (i.e., examining births that occurred while the study was in progress) suggest the overall rate for FAS in the Western world is .29 per 1000 for Caucasians and .48 per 1000 for African Americans [21].

Widespread research collating data from different countries (e.g., United States, Canada, United Kingdom, Sweden, New Zealand, and Australia) supports general population estimates of between one and three per 1000 live births for full diagnosis of FAS [21, 22]. These incidence rates have been confirmed by reports from Australian obstetric hospitals [23].

Official statistics are not available in Australia as many authorities do not consider FAS and FAE notifiable disorders. Possibly, clinically recognizable FAS represents only the tip of the iceberg with many cases remaining undiagnosed at birth. Instead, alcohol-related birth defects are classified into the ICD-9-CM code 655.4 category, which includes suspected damage to the fetus from other diseases in the mother. This classification is ambiguous as a number of other maternal conditions affecting the fetus are assigned to this code [11]. As a result, health authorities, despite acknowledging FAS, have concluded there is insufficient evidence to support birth defects are caused by alcohol consumption during pregnancy [11]. However, in the absence of local data, American figures of 1.9 per 1000 live births have been applied to Australian Bureau of Statistics birth data [24]. This figure suggests approximately 500 children are born annually in Australia with a full diagnosis of FAS.

It has been estimated FAS births average twenty-five per 1000 in women who are chronic sufferers of alcoholism, with 17 percent of children dying in the first week of life from heart failure, upper respiratory tract infections, or convulsions [1]. High estimates have also been associated with indigenous populations in Australia, who comprise the highest recorded percentage of problem drinkers worldwide [23]. In addition, an increased prevalence of FAS has been linked to indigenous groups in the United States and Canada [7].

Far more widespread is FAE which affects a greater number of families, many of whom are not identified as having an alcohol consumption problem [16]. Current statistics estimate the incidence of FAE to occur in approximately five to six per 1000 live births [22]. In terms of Australian figures, this reflects a conservative estimate of approximately 1600 births diagnosed per annum based on recent census date [24].

THE IDENTIFICATION OF "AT RISK" GROUPS

An important step in implementing prevention programs is to identify and target *at risk* populations. The targeting of these groups with specialized prevention programs will help in decreasing the incidence of FAS in the future. At the extreme end of the continuum, all fertile sexually-active women who consume alcohol could be identified as being *at risk*. It must also be noted, birth rates for teenagers and women between the age of thirty and forty-four years are on the increase [24].

Research has shown that heavy drinkers are significantly more likely to be African America, poorly educated, and multiparous, in comparison to moderate and light drinkers [25]. However, extensive clinical research by Mills and Graubard has identified women at most risk for alcohol consumption during pregnancy are of European descent, highly educated, twenty to thirty-four year olds [26]. Therefore, women who are not alcohol abusers/dependent, but for whom alcohol plays a role in social interaction, need to be targeted [27]. Research shows women most commonly quote social reasons for drinking alcohol, as opposed to drinking to experience the intoxicating effects of alcohol [28].

Female population subgroups at most risk in Australia are sexually-active teenagers, younger adults, career women, and female aboriginals. However, recent statistics indicate consumption levels in ethnic groups is low [10] minimizing the need for targeting specific cultural groups. The 1993 National Drug Strategy household survey found 50 percent of women drink alcohol at least one day per week [29]. In addition, 50 percent of teenage girls consume alcohol prior to fifteen years of age with two-thirds of young female drinkers classified as heavy drinkers, which represents the highest rate of any population group [29]. Also of concern is knowledge that younger adults (20 to 24 years) drink more heavily when they drink (i.e., binge drink), even though they drink less often than older groups [29].

Furthermore, American and Australian studies have confirmed between 55 and 88 percent of women drink at least once during pregnancy, while approximately 20 to 35 percent drink regularly throughout the gestational period [14, 25, 30]. Generally, consumption rates tend to be highest at conception with marked decreases in drinking patterns occurring on confirmation of pregnancy in the first trimester. Unfortunately, these drinking patterns are known to overlap with embryonic development [31].

Recent large-scale longitudinal studies by Bruce, Adams, and Shulman report percentage rates for American women drinking alcohol throughout pregnancy decreased from 53.8 percent for light drinking (defined in the present study as 1 to 6 drinks per week), in the three months prior to pregnancy to 15.1 percent in the final trimester of pregnancy [32]. Moderate consumption (i.e., 7 to 13 drinks per week) decreased from 3 percent to .30 percent while heavy drinking rates (i.e., 14 or more drinks per week) decreased from 1.3 percent to .13 percent.

These results, which in overall terms are in accordance with the Australian National Drug Strategy [33] statistics for women, show drinking levels in the conceptual period are excessive. This highlights the importance of targeting all sexually-active women of child-bearing age to reduce the incidence of alcohol-related birth defects.

O'Connor has revealed in remote regions 26 percent of pregnant Aboriginal women consume alcohol regularly throughout pregnancy, while 8 percent were reported highly intoxicated at least every week [34]. Furthermore, 25 percent of babies born to these women experienced growth retardation and poor nutrition. However, intervening with such "at risk" populations is a complex task which must account for the individual and cultural needs of each target group.

Reports comprised for Australian health authorities acknowledging alcohol consumption among pregnant Australian women is uncommon at harmful and hazardous levels [11] need to be treated cautiously. Meta-analytical studies by English et al., assessing alcohol intake in pregnant women, have been based on Tasmanian hospital surveys which may not reflect consumption levels on mainland Australia [11]. According to the Australian Bureau of Statistics, the state of Tasmania has the lowest overall alcohol consumption rates in Australia [10]. Such conclusions can be harmful to women, as by denying the true extent of maternal alcohol consumption in Australia these reports hamper the implementation of prevention programs.

REVIEW OF PREVENTION STRATEGIES— AN OVERVIEW

The importance of prevention programs has been widely acknowledged. To date, two main approaches have been adopted in implementing FAS and FAE prevention programs. Primary prevention programs have targeted the wider community including children and adults of all ages. School-based programs have aimed to increase the level of awareness in children and adolescents. Community groups have also worked to support educational programs at all levels. In addition, media and industry-based programs have targeted the general population through advertising campaigns and warning labels on alcohol beverages.

Secondary prevention procedures have been aimed at pregnant women in the clinic to raise awareness of FAS and dangers associated with maternal alcohol consumption. Information disseminated through clinic-based programs has targeted "at risk" women to decrease or cease alcohol consumption. Culturally-oriented clinical programs have also targeted indigenous groups in America.

School-Based Programs

Despite an emphasis in scientific literature on the importance of targeting schools for implementing primary prevention programs, there remains a paucity

of empirically-based research examining the effects of programs undertaken in the classroom. Parental consent, confidentiality issues, and the nature of the topic—pregnancy and alcohol—have conceivably imposed limitations on this research. The limited literature available on classroom-based programs has revealed that the dissemination of information to students about pregnancy and alcohol has been combined with general drug and alcohol educational programs [35, 36]. These programs have focused on drug abuse, unplanned pregnancy, and sexually transmitted diseases, with an emphasis on abstinence as opposed to addressing pregnancy and alcohol directly. Educational programs aimed at adolescents, in particular, need to be taken a step further. In developing specific programs for adolescents on pregnancy and alcohol, emphasis needs to be placed on pre-conception care; unplanned pregnancy; FAS and FAE; the teratogenic effects of alcohol; and problems confronted by parents of children with FAS and FAE.

Community-Based Programs

The role of community organizations has been important in educating at risk groups. Specialist programs on FAS have focused on high risk teenage groups exposed to substance abuse in the home, economically disadvantaged children, and those populations with high teenage pregnancy rates [37, 38]. Such programs have received strong community support despite a lack of direct parental involvement. Peer support programs aimed at teenagers can also be an important component of community-based programs [39, 40]. Research by Perry found peer-led drug abuse prevention programs focusing on life skills help teenagers with respect to drug related behavior [40]. Significant changes in attitudes and behavior were noted when compared with teacher-led programs [40]. Adolescents learning to support one another can offer assistance when encountering “high risk” situations.

Media Campaigns

Large-scale media campaigns have targeted the general population. Only newspapers, magazines, radio, and television advertising adopting a non-moralistic approach have been successful in changing attitudes toward the use of alcohol in pregnancy [41, 42]. Messages that have been linked to fear and lack information on how to affect behavioral change have been ineffective in changing drinking patterns and raising awareness of FAS and FAE [43]. In addition, public service announcements directed at women of child-bearing age recommending abstinence, or a decrease in drinking patterns, have had only a limited impact [3]. A major disadvantage of media campaigns is that high risk women are least responsive to the broad approach associated with this form of advertising.

Industry's Response to Prevention

The legislation of the Beverage Labelling Act in 1988 in the United States of America forced the alcohol industry to adopt responsibility for informing pregnant women of the risk of birth defects associated with alcohol consumption. As noted by Hankin, Sloan, Firestone, Ager et al. [44, 45], the labeling law is a social intervention designed to reduce the prevalence of all alcohol-related birth defects. Even prior to implementation the warning label concept received overwhelming support from all population subgroups surveyed, including heavy drinkers [46].

Within four months of the industry responding to this law a significant increase in awareness about the warning label occurred in young women [44] who comprise a high risk group. An overall decline in drinking patterns amongst lighter drinkers was also noted [42, 45]. However, despite these U.S. findings, the 1988 recommendation by the Australian College of Paediatrics that all alcoholic beverages should be labeled *Alcohol consumption during pregnancy is not recommended* is yet to be implemented in Australia.

Clinical Programs

A variety of clinically-based prevention programs have targeted both pregnant and nonpregnant women. At the individual level self-help programs, cognitive therapies, and behavioral management programs have been effective in helping the problem drinker. In particular, counseling has been effective in reducing alcohol consumption in alcohol abuse/dependence.

However, at a global level clinics have also been effective in educating pregnant women about the dangers of drinking, encouraging a reduction in consumption during pregnancy, and promoting abstinence in subsequent pregnancies. The distribution of pamphlets in antenatal clinics, combined with verbal instruction from medical professionals, has been effective in raising awareness of FAS and FAE [13]. However, written material in the form of well presented booklets has proven to be more popular among clinical clients. Knowledge also increased in pregnant adolescents when targeted by a clinically-based substance abuse educational program and 47.6 percent of subjects decreased or ceased substance abuse [47].

Culture-Specific Prevention Programs

A great deal of care has been taken in developing community based programs for indigenous North Americans which reflect cultural ways. Tribal health centers have had a positive impact in raising awareness of FAS and FAE in the local communities. The distribution of prenatal packages and implementation of school-based programs have raised awareness, with 50 percent of women able to describe some of the features of FAS [48] compared with 21 percent in the general population [49]. In addition, when pregnancy is diagnosed a drinking

history is taken for each woman receiving prenatal care. Those who positively respond to alcohol consumption, regardless of amount, are referred to the "Fetal Alcohol Program" [50]. Over 90 percent of clients attending this program ceased drinking after undertaking education programs, viewing pictures and video tapes of children with FAS, and undergoing counseling.

A DESCRIPTION OF EMPIRICAL STUDIES

Table 1 displays a description of five studies chosen for analysis based on the selection criteria previously mentioned. The limited availability of empirically-based studies determined the type of prevention program to be reviewed. Studies addressed prevention across a range of populations including the general public, pregnant women, community samples, school children, and indigenous groups. Of the five studies reviewed, three focused on the effects of warning labels on alcoholic beverages as a means of raising awareness. One study addressed the combined effect of educational programs delivered by trained personnel dispensing print and video material. The final study adopted an innovative method of educating low-income women by using an interactive computer-based multimedia package.

Limitations occurred with two of the studies analyzed in Table 1 as non-randomized groups were used for data collection [see 38, 51]. The May et al. [38] study focused on indigenous people while Kinzie et al. [51] recruited low income women with low literacy levels as participants. Furthermore, three studies (refer to Table 1) focused on clinical populations with results indicative of awareness levels in pregnant women, but not representative when applied to the general population. Only the Hilton et al. [46] study utilized random sampling. In addition, control groups were not used for comparative studies. This can be justified in terms of clinical research as it would be unethical to identify pregnant women who consumed alcohol and withhold education and assistance. Large sample sizes were used with three of the five studies. Only one study, Kinzie et al., relied on a small sample set. Baseline data was not collected in any of the studies reviewed [51]. Despite the methodological flaws in the above studies all revealed an increase in awareness of FAS and the detriments associated with maternal alcohol consumption among the populations targeted. The large-scale study by Hankin and colleagues [44, 45], in terms of sample size and duration of the study, added weight to the interpretation of this research when all studies were compared. However, despite an increase in awareness of FAS and FAE, this knowledge was not reflected in a reduction in drinking patterns of high risk drinkers [45]. These results must be interpreted cautiously, as to reveal the true effectiveness of prevention programs well designed longitudinal studies are required. This research would need to monitor the reduction in alcohol consumption levels in women and decreased incidence of FAS, in conjunction with the use of prevention programs.

Table 1. Results of the Five Empirical Studies Reviewed on Alcohol and Pregnancy

Study	<i>n</i>	Sample Demographics	Design
Hilton et al. (1991)	2006	General Population Males and Females (18-60+)	Telephone survey
Hankin et al. (1993a)	5169	Pregnant Women Mean age = 23.9 years	Antenatal screening questionnaire
Hankin et al. (1993b)	12026	Pregnant Women Mean age = 23.7 years	Antenatal screening questionnaire
May et al. (1989)	473	Schoolchildren (<i>n</i> = 215) Indigenous Community sample (<i>n</i> = 258)	Survey
Kinzie et al. (1993)	99	Pregnant women Time 1 <i>n</i> = 40 Time 2 <i>n</i> = 59	Antenatal clinic: Computer administered questions

Many advantages associated with prevention programs have been identified in the five studies reviewed. All studies reported increases in knowledge levels and/or support for public prevention campaigns (e.g., labeling, printed material). Warning labels on beverages have a place in prevention as they increase awareness of FAS and FAE in younger women and the nonrisk drinker [45]. Labeling alcoholic beverages has not been entirely effective as a decrease in alcohol consumption in heavier drinkers has not been found, which is consistent with the low response by this group to media campaigns [42, 45]. Pregnant at risk drinkers continue to consume alcohol despite warning labels. Hankin found prior success in pregnancy outcome, when combined with maternal alcohol consumption, accounted for continued alcohol consumption in ongoing pregnancies of those studied [42].

The macro-level FAS prevention program targeting indigenous Americans was successful in targeting all age groups from children in Grade 5 onward, as well as community and prenatal groups [38]. Pamphlets and fact sheets were distributed by trained personnel throughout the entire community with posters placed in strategic positions. Slides were also used in delivering the program to participants. Retention of knowledge evaluated in follow-up sessions showed

Type of Prevention Program	Duration	Results
Public support for warning labels on alcoholic beverages	2mths*	87 percent supported warning labels
Knowledge obtained from warning labels	3 years	Time series analysis showed awareness increased from 31 percent to 75 percent in three years
Reduction in consumption levels due to labeling	5 years	No decrease in drinking levels for risk drinkers
Awareness based on information presented by trained personnel, video, posters, leaflets, fact sheets	Not stated, 2-3 month follow-up	50 percent increase in knowledge gained in children and 71 percent increase in community sample, *84 percent of all groups retained knowledge on retest
Interactive computer-based alcohol education programs	Not stated	*75 percent to 81 percent of subjects increased knowledge levels

significant information retention with 84 percent of subjects still aware of FAS. The enthusiasm, motivation, and positivity generated by the trained personnel also contributed to the success of the program [38].

The innovative method of using an interactive computer-based multimedia package trialed by Kinzie et al., has taken advantage of technological advances [51]. Low-income poorly educated women in a rural region were targeted with this method. Of the two groups surveyed, 75 to 81 percent of subjects increased knowledge levels of FAS and FAE. Additionally, interest was expressed in other educational packages based on this system. Advantages of computer-based learning programs are that less demand is placed on staff, thus allowing health-care workers to become involved with clinical tasks, as well as reducing running costs. The disadvantage associated with using computer-based prevention programs is the initial installation costs.

Limitations are evident in the direction prevention strategies have adopted to date. Despite the increased awareness of the dangers associated with alcohol consumption and pregnancy, this knowledge has not necessarily resulted in behavioral change. The prevention programs reviewed identified the characteristics associated with FAS, and detriments of maternal alcohol consumption in

pregnancy, but failed to offer strategies for behavioral modification. This possibly accounts for the failure of high risk drinkers to reduce alcohol consumption during pregnancy. Future programs need to be more specific and not only address the characteristics of FAS but detail the teratogenic effects of alcohol. Greater awareness of alcohol's effect on physiological processes in males and females, combined with effective psychological strategies for adopting behavior change, are essential. The continuation of specialist clinical intervention programs, and outreach, provided at an individual level must be maintained for high risk drinkers in addition to prevention programs.

IDENTIFYING EFFECTIVE APPROACHES IN PREVENTION

Effective preventative measures which are influential in adopting change are threefold. The importance of school-based and clinical programs provided in conjunction with support from community organizations, as adopted by indigenous groups in America, cannot be overemphasized. Due to the increasing changes in family structure, schools will continue to play an important role in prevention. The teenage population represents the most important group to target when implementing prevention programs for long-term success.

As noted by Amatetti, effective school-based prevention programs must move beyond the classroom and target the family, community, and society as a whole [35]. Adolescents can play a role in disseminating information to these groups through the distribution of leaflets provided in school programs [e.g., 52]. In addition, the alcohol industry can work with the community by sponsoring speakers to target women's groups, mothers at child care centers and preschools, as well as parent bodies attached to schools.

The successful components of culture-specific programs on FAS and FAE (i.e., outreach within the community, community-based workshops delivered by trained personnel, and distribution of printed material) can be adopted in raising the awareness of Aboriginal women in Australia. These programs could also be applied to the general population. Modeling the approach taken with North American Indian groups [e.g., 50] will be a positive step in adopting FAS prevention programs for Aboriginal women in Australia.

FUTURE DIRECTION FOR PREVENTION PROGRAMS

To date, access to prevention programs has been minimal despite the Australian College of Paediatrics recommendation supporting education of the general public about the risks associated with combining alcohol and pregnancy [53]. Overseas prevention programs have played a particularly important role in raising awareness of FAS as nations strive toward the World Health Organizations goal of reducing the incidence of FAS to 0.12 per 1000 by the year 2000 [49].

Generally speaking, prevention programs overseas have been successful in raising public awareness [54]. To achieve a successful outcome in implementing prevention programs in Australia, a multi-faceted approach needs to be adopted to significantly decrease the incidence of all alcohol-related birth defects, in particular, FAS and FAE.

First, acknowledgment of all alcohol-related birth defects by health authorities is essential. Training schemes need to target established medical professionals, as well as trainee students in health-related disciplines, in raising awareness of alcohol-related birth defects and care of clients. Health care providers need to play an active role in decreasing FAS and FAE by identifying and assisting women at risk. The compilation of a drinking history for all pregnant women should become a routine part of antenatal care. Also as part of routine clinical care a personal approach by health professionals, combined with the provision of printed material, is recommended for informing all pregnant women about the dangers associated with alcohol and pregnancy [55]. Pre-conception care courses are an ideal medium for informing women of dangers associated with alcohol consumption [56]. The provision of written material combined with verbal instruction has been found to decrease alcohol consumption levels in pregnant women [19, 52]. The inclusion of information on the effects of alcohol in planning pregnancy in these courses is warranted.

Second, schools need to be targeted as a primary source of disseminating information by increasing priority in human relations courses of the importance of health care prior to and during pregnancy. Moreover, an emphasis needs to be placed on the teratogenic effects of alcohol and detriments associated with binge drinking, by increasing awareness about the dangers associated with pregnancy and alcohol consumption. In addition, the focus needs to address relationship issues which encompass the importance of safe sex and planned pregnancy, as it has been suggested that a tripartite link exists between unprotected sex, unplanned pregnancy, and alcohol consumption [36].

Third, awareness in the general community can be increased through media exposure. Women need to be encouraged to modify social drinking habits as many remain unaware of their pregnancy in the important early stages. In addition, the alcohol and beverage industry needs to accept responsibility and acknowledge to consumers there are dangers associated with mixing alcohol and pregnancy. Labeling in America has been effective in educating younger women who, in Australia, comprise the highest risk group for alcohol consumption and unplanned pregnancy. However, a viable alternative in targeting all "at risk" women exists. The funding of prevention programs by the alcohol and beverage industry as a tax incentive could lessen the financial burden of implementing such programs.

Fourth, due to Australia's high alcohol consumption levels educational programs on pregnancy and alcohol need to address paternal drinking patterns as well. Recent research indicates alcohol affects the condition of the sperm,

leading to behavioral problems and intellectual impairment in the offspring [57]. Furthermore, males can play an important role as a supportive person in helping to reduce alcohol consumption in pregnant partners, or those planning a pregnancy [3].

Finally, for Australia's indigenous people, specialist culture-specific programs that account for cultural values, traditions, and taboos need to be developed to target Aboriginal women [34]. Success will only be achieved when programs such as these are sanctioned by elders and delivered by indigenous women.

Prevention needs to be multifaceted to be effective, and this costs money. However, the lifetime care for one child with FAS costs the community approximately US\$596,000 [58]. The cost of prevention cannot be argued, only the means of implementation. Furthermore, costs associated with the more prevalent FAE will also decrease, therefore, money channeled into prevention is dollars saved in long-term care.

ETHICAL CONCERNS RELATED TO PREVENTION ISSUES

The identification and targeting of women for the implementation of prevention programs is not without its problems. Civil liberties dictate that everyone has the right to drink alcohol by choice. Recent statements made by the Australian Medical Association, from an inquiry into fetal welfare and the law [59], support the rights of the mother ahead of those of the fetus [60]. Pregnant women in Australia have the legal right to consume alcohol during pregnancy, despite the well-documented damages associated with fetal development and in-utero alcohol exposure resulting in conditions such as FAS. However, in moral terms, one must question if women are ethically obliged to protect the health of the unborn child. To make such a choice, women first need to be informed of the dangers associated with maternal alcohol consumption.

The issue of fetal dependence upon the mother needs to be considered [61]. Extensive empirical evidence has chronicled the dangers to the fetus associated with alcohol consumption. Therefore, in terms of implementing prevention programs a shift in government policy and attitudes among professional bodies is warranted. Legislation needs to adopt a supportive approach, as laws that criminalize drinking women only exacerbate the problem [62]. More importantly, legislation which promotes just and balanced laws, with a positive outcome for both the mother and unborn child [63], will strengthen preventative efforts in targeting "at risk" women.

The role of health-care professionals also needs to be addressed. Reports by Lelong, Kaminski, Chwalow, Bean, and Subtil indicate those best able to assist women abstaining or at least decreasing alcohol consumption during pregnancy are partners, doctors, and midwives [64]. This study also highlighted 70 percent of heavy smokers who were advised to reduce their intake by the medical

profession during pregnancy, while only 20 percent of heavy drinkers were advised to reduce alcohol consumption. An additional survey of American practitioners found only 53 percent questioned clients routinely about maternal drinking patterns [65]. With such widespread evidence documenting fetal deficits associated with alcohol consumption, the lack of information provision and support to clients from health-care professionals is disappointing, as women have the right to be informed. Health-care professionals have an important role to play in the detection, education, and, where necessary, referral of at risk pregnant clients [66].

In addition, the alcohol industry's failure to respond to the Australian College of Pediatricians recommendation should be addressed. Consumer groups need to target the marketing, availability, and labeling of alcoholic beverages aimed at women [67]. The introduction of health warnings on alcoholic beverages will raise awareness among women, even at a minimal level, and protect the alcohol industry from future litigation.

SUMMARY AND CONCLUSION

This article has reviewed the role of prevention in decreasing the incidence of FAS and FAE by raising awareness of "at risk" groups. The characteristics, mechanisms, and prevalence of FAS and FAE were addressed to increase knowledge of this identifiable syndrome and its partial effects. An analysis of prevention programs has drawn attention to successful strategies which can be modified and adapted for targeting "at risk" women worldwide. The identification of "at risk" women has found a number of groups—adolescents, binge drinkers, the social consumer, and indigenous women—need to be targeted for education. Most importantly, government health authorities and professional bodies need to be made more aware of the ethical issues concerning alcohol and pregnancy.

From the above research it can be concluded FAS is a disorder which, in time, can be reduced in prevalence with the implementation of effective prevention programs. Alcohol will continue to be a part of the social fabric of society, therefore, prevention programs to decrease alcohol-related birth defects are essential. Despite the ongoing need for prevention, programs so far have not been entirely successful in lowering the overall incidence of FAS. If the reduced prevalence rates obtained from clinical studies published by Abel and Sokol reflect population-based figures, FAS has decreased in America since the introduction of prevention strategies [21]. However, this finding needs to be replicated in population and community-based studies. An additional flaw in prevention programs has been reflected in alcohol consumption patterns in heavy drinkers, those at greatest risk. Only moderate success has been achieved in reducing consumption patterns in 'high risk' pregnant women as noted by the Hankin et al. [45] study.

Prevention strategies used to date have been effective in raising awareness levels, as the five studies reviewed found increased awareness levels across all groups. The challenge now becomes one of extending this so changes are reflected in behavior of both males and females. Prevention strategies need to take a new direction and focus on teaching strategies for behavioral change as a priority. Furthermore, there is sufficient evidence to support the implementation of prevention programs in Australia. However, to be successful prevention programs need to target specific "at risk" groups. The outcome of prevention programs for specialist groups has shown prevention strategies do work if tailored to the needs of the specific group [38].

Finally, the importance of implementing prevention programs to build awareness cannot be overemphasized as an early solution in targeting all "at risk" groups. Ongoing research is required to improve the present approaches in prevention so that maternal alcohol consumption continues to decrease across all groups. There is no safe level, or time, for consuming alcohol when pregnant or planning a pregnancy. Prevention is the only solution in decreasing the overall incidence of all alcohol-related birth defects.

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