FASD prevention school-based program for children and adolescents in select urban, rural and First Nation schools in Ontario, Canada

Report prepared for the Public Health Agency of Canada

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Any errors or omissions in this report are the sole responsibility of the authors.

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Abbreviations

ACA: Active Case Ascertainment
ACE: Adverse Childhood Experiences
ADD: Attention Deficit Disorder
ADHD: Attention-deficit/Hyperactivity Disorder
AOR: Adjusted odds ratio
ASD: Autism Spectrum Disorder
AUD: Alcohol Use Disorder
CAMH: Centre for Addiction and Mental Health
CanFASD: The Canada Fetal Alcohol Spectrum Disorder Research Network
FAS: Fetal Alcohol Syndrome
FASD: Fetal Alcohol Spectrum Disorder
FNIGC: First Nations Information Governance Centre
ICD-10: The International Classification of Diseases, *Version 10*
ICES: Institute for Clinical Evaluative Sciences
ID: Intellectual Disability
IQR: Interquartile range
IUGR: Intrauterine growth restriction
LRDGs: Low-Risk Drinking Guidelines
MHA: Mental Health and Addictions
MOHLTC: Ministry of Health and Long-Term Care
N/A: Not applicable
NAS: Neonatal Abstinence Syndrome
ND: Neurodevelopmental Disorder
OCD: Obsessive-Compulsive Disorder
ODD: Oppositional Defiant Disorder
ON: Ontario
OR: Odds Ratio
PAE: Prenatal Alcohol Exposure
pFAS: Partial Fetal Alcohol Syndrome
PHAC: Public Health Agency of Canada
PHU: Public Health Unit
PS: Passive surveillance
PTSD: Post-Traumatic Stress Disorder
SD: Standard deviation
SES: Socioeconomic Status
SFF: Sentinel facial feature(s)
SUD: Substance Use Disorder

1.0 EXECUTIVE SUMMARY

The FASD Prevention School-Based Program, supported by Public Health Agency of Canada National Strategic Projects Fund, and conducted at the Centre for Addiction and Mental Health, is an initiative designed to prevent alcohol use during pregnancy and to reduce the risk of Fetal Alcohol Spectrum Disorder (FASD) by promoting knowledge, awareness and prevention strategies among children and adolescents aged 12 to 18 (Grades 7-12) in students from selected schools serving urban, rural, and First Nation communities across Ontario, Canada.

This PHAC-funded project (2019-2024) had the following specific objectives:

1. **Prepare, modify, and culturally adapt** a school-based FASD prevention education curriculum for implementation in select Ontario schools serving urban, rural and First Nations communities. This was done by adapting the 2006 NOFAS curriculum, developed by the Centers for Disease Control and Prevention (CDC), which aimed to teach students about the risks of alcohol use in pregnancy, including FASD. The FASD prevention education curriculum was adapted to be culturally relevant, context-specific for Ontario, Canada and to balance FASD prevention with strengths-based messaging around individuals living with FASD. The curriculum sought to encourage children and youth to be tolerant and accepting of all individuals notwithstanding capabilities or disabilities, including individuals with FASD.
2. **Implement the adapted curriculum** in 12 selected Ontario schools to increase knowledge and awareness among students of the risks of prenatal alcohol and other substance use to develop their understanding of FASD and other health consequences;
3. To **evaluate the effectiveness** of the FASD prevention education curriculum and fill an information gap in the FASD prevention research literature;
4. To **develop a report, or "tool kit"** outlining all aspects of the project, including cultural adaptation, implementation and evaluation. This tool kit contributes to the sustainability of the project, and would guide future implementation and uptake and guide replicability of the FASD prevention education curriculum for provincial and territorial Ministries of Education.

Methodology:

This pilot project used a mixed methods design to implement and evaluate the effectiveness of the FASD prevention education curriculum in twelve participating schools. The intervention schools implemented the *FASD prevention education curriculum* and the comparison schools participated in regular (default activities) as scheduled. The project sought to have a target sample size of 900 students. This sample was comprised of approximately 300 participating middle school students (150 in the intervention and 150 in the control group); and approximately 600 high school students (300 in the intervention and 300 in the control group).

Descriptive statistics were generated from the student surveys to produce group summary measures, pre- and post-implementation. Independent t-tests and paired t-tests were conducted to examine changes at the pre-test and post-test stages. Linear regression models were built to examine the condition (intervention) as a predictor (independent) variable on several student outcomes (dependent variables) at the post-test stage.

Data on effectiveness and student/teacher feedback are integrated and synthesized for the purpose of stating the overall findings and highlighting future recommendations for both research and school-based FASD prevention initiative implementation.

Results:

Two turn-key lesson plans were developed: 1) for schools serving urban and rural non-faith based schools (i.e., mainstream schools); and 2) schools serving students from First Nations communities. The latter incorporates Indigenous knowledge and perspectives to address the unique needs of First Nation communities while being inclusive to all students.

The lesson plan utilizes engaging, evidence-based teaching methods such as discussions, role-playing, and multimedia resources. The lesson plan highlights the importance of avoiding alcohol during pregnancy and the role of supportive behaviors in promoting healthier choices. Delivery of the project involved researchers, educators, and community leaders to ensure relevance and effectiveness.

The study was implemented in a total of twelve schools, reaching a total population of 644 students: five schools in urban communities (180 intervention; 100 control students); two schools in rural areas (66 students in control only); and five schools serving students from First Nations communities (298 students: 206 intervention; 92 control).

Urban Schools

Pre-test and post-test analyses showed that for students in urban schools (intervention vs. control), the FASD prevention education curriculum was effective in teaching students about the risks of alcohol use in general, and during pregnancy, as well as in increasing their overall content knowledge of FASD. Linear regression models indicated that the FASD prevention education curriculum was significantly associated with higher content knowledge of FASD and higher proportions of students indicating it is “personally important to them to understand how to have and support alcohol-free and drug-free pregnancies” and that “FASD prevention is personally important to them”.

Schools serving First Nations students

Pre-test and post-test and analyses for First Nations schools (intervention vs. control) shows that the FASD prevention education curriculum was effective in teaching risks of alcohol use in general, and during pregnancy, as well as in increasing their overall content knowledge of FASD. The intervention was associated with higher proportions of students indicating that it is “personally important to them to understand how to have and support alcohol-free and drug-free pregnancies”. Linear regression models showed that the FASD prevention education curriculum was significantly associated with higher content knowledge of FASD.

Students in the intervention group as compared to control group:

- demonstrated greater understanding of the risks of PAE and FASD;
- were better equipped to make healthier choices regarding alcohol use and to support peers in preventing substance-related harm.

Rural Schools

Findings from rural schools (control condition only) showed that testing in this context seems to increase the proportions of students indicating a belief that there is no safe time or frequency of alcohol consumption during pregnancy and that the safest choice is for a woman to

stop drinking completely once she learns she is pregnant. Interestingly, testing decreased the overall FASD content knowledge scores for both incorrect and correct items identified.

Conclusions

A great deal of positive feedback was received on the FASD prevention education curriculum (both versions) used in the intervention, from students and teachers. These qualitative data (un-quantified) revealed that many students believed the curriculum did not need improvement, and that the curriculum needs to be more widespread, with more large-scale efforts to increase FASD awareness in general, both during and after school. In fact, the majority of teachers surveyed recommended this lesson plan to be included in the Ontario Health curriculum for both middle school and high school grades, upon modification as suggested by them.

Feedback from students and teachers also revealed opportunities to improve the curriculum, making shorter the length of the presentation and more visually appealing, engaging and/or interactive.

Recommendations

- Broader implementation of FASD prevention education curriculum is needed. Based on interest expressed by principals and teachers of participating schools, this curriculum should be available to more schools across urban, rural, and remote communities in Canada.
- This FASD prevention education curriculum can be included to complement the existing Ontario Ministry of Education curriculum for Grades 7-12 in health and physical education, family studies, and biology.
- It would be necessary to use feedback from students and teachers to refine the lesson plan and update delivery methods.
- It would be necessary to conduct longitudinal evaluations to assess long-term impact on students' behaviors and attitudes over time.
- This school-based FASD prevention initiative can target younger students (in earlier grades) to build foundational knowledge.

This FASD Prevention School-Based Project exemplifies a proactive approach to health education, addressing a critical public health issue of alcohol use during pregnancy and FASD through culturally sensitive, evidence-based interventions tailored for youth. Implementation of this FASD prevention education curriculum has the potential to lead to a decrease in alcohol-exposed pregnancies and thus, decreased incidence rates and overall prevalence of FASD, as well as a reduction in stigma against people with FASD and their families.

2.0 BACKGROUND

2.1 Alcohol use in pregnancy

Alcohol consumption is prevalent in Canada, and alarmingly, levels of consumption and binge drinking are increasing among young women and women of childbearing age (1, 2). This

is due to a variety of reasons, including the increasing availability and accessibility of alcohol use, as well as alcohol advertising and deregulation of alcohol sales (1, 3). Recent social, political and public health also may play a role, including the COVID-19 pandemic and associated social distancing measures and adverse impacts on mental health (4), as well as the recent policy implementation of alcohol sales in grocery stores and convenience stores (3, 5). The largest increases in emergency department visits attributable to alcohol use have been among women and young adults since 2003 (6), which indicate a substantial health risk to childbearing age (15-49 years) women. For youth in particular, such policy changes make them more likely to transition from alcohol abstinence to high-risk drinking (7). Additionally, the Low-Risk Drinking Guidelines from 2011 suggested that youth consumption of two drinks or less per week could be low-risk under parental consent/supervision (8). The newer Low Risk Drinking Guidelines in 2023 provide the same content for youth, though there is a recommendation to delay drinking until the age of 25, as alcohol use can have a significant impact on body and brain development in youth (8). The Ontario Student Drug Use and Health Survey found that in 2017, 10.5% of grade 7 students, 31.8% of grade 9 students and 68.3% of grade 12 students used alcohol in the past year (9). Results show that 9.2% of students in grade 9 and 32.3% of students in grade 12 binge drank in the last year (9).

For women of childbearing age, alcohol use is important to examine and monitor for alcohol-associated harms, including harms to reproductive health. Alcohol has been well-established as a teratogen (10), as alcohol readily crosses into the placenta, where it can pose risks to the fetus. Alcohol use during pregnancy has been established as a risk factor for adverse pregnancy outcomes including stillbirth (11), spontaneous abortion (12, 13), premature birth (13), intrauterine growth retardation (14) and low birthweight (15). One of the most disabling and long-term outcomes associated with alcohol use during pregnancy is the risk of Fetal Alcohol Spectrum Disorder (FASD) in the child (16, 17), which is a lifelong, neurodevelopmental disorder associated with many adverse health and social outcomes.

The measured prevalence of alcohol use in pregnancy varies depending on the method of measurement. For example, meconium testing at birth generates higher prevalence estimates as compared to self-report from pregnant women (18). A recent study using 2015-2018 data from the Better Outcomes Registry & Network (BORN) Ontario found a prevalence of 2.4% for alcohol-exposed pregnancies based on self-report data (19), which produces a gross underestimate of the true prevalence. Based on survey data, which is less subject to social desirability bias compared to data on alcohol use in pregnancy gathered in the clinical setting in face-to-face interviews (20), we estimate that alcohol use in pregnancy occurs at a higher level than is suggested in studies based on clinical data. A comprehensive literature review and meta-analysis by Popova and colleagues (2017) revealed that the prevalence of alcohol consumption during pregnancy is about 10.0% (95% confidence interval [CI]: 5.2%–16.2%) of women in the general population, and about 3.3% (95% CI: 2.6%–4.2%) of these women engage in binge drinking (4+ drinks per occasion) during pregnancy (21, 22). A similar study found that a higher proportion 35.3% (95% CI: 24.5%–46.9%) of women in First Nations populations consume alcohol during pregnancy and approximately 22.0% (95% CI: 0.0%–52.1%) of First Nations women in Canada, binge drink during pregnancy (23). An analysis of different data from the Canadian Maternity Experiences Survey (MES) reveals that alcohol consumption during pregnancy ranges from 4 to 13.8%, depending on the province and region, resulting in an overall estimate of 10.8% (24). These estimates are based on maternal self-reports and therefore, likely conservative. It has been found that testing meconium for fatty acid ethyl esters (products of non-

oxidative ethanol metabolism), results in a prevalence estimate that is 4.3 times higher than that obtained via maternal self-reports (18). Despite an array of screening measures for alcohol use in pregnancy, including clinician-directed screening in prenatal care settings, validated alcohol use screening tools (e.g., T-ACE) and laboratory screening tools (e.g., meconium), alcohol use screening is under-utilized and therefore many cases are missed (25). This impacts the validity of epidemiological studies focused on routinely collected exposure data, such as those from birth registries. Conversely, cohort studies offer potential to measure alcohol use in pregnancy more thoroughly, with additional opportunities identified in measuring alcohol use frequency and quantity during pregnancy (26).

Alcohol use during pregnancy is important to examine in the greater context of substance use, as there have been various studies that have found that the use of other substances during pregnancy amplifies the adverse impacts of alcohol use (19). For example, though the prevalence is quite low, tobacco use still occurs in pregnancies in Canada. Specifically, 20% to 25% of women who smoke tobacco, will continue to smoke during pregnancy (27). Smoking noted at the first prenatal visit was found to be associated with a higher odds of heavy drinking (binge or weekly) in a recent population-based study in Ontario (19). Similarly, while the prevalence of other substances, such as opioids, cocaine and cannabis, tend to be low in the general population of Canada (1.1%; <1%; and 2%, respectively) (19, 28, 29), these are also known to amplify the odds of pregnancy complications, adverse birth outcomes and neonatal health complications when consumed in conjunction with alcohol. Prenatal exposure to one or more substances in addition to alcohol was associated with significantly higher odds of fetal/maternal/placental pregnancy complications; preterm birth; NICU admission; low APGAR scores; one or more confirmed congenital anomalies at birth; respiratory distress syndrome; and intrauterine growth restriction (19).

Alcohol use during pregnancy occurs in a context of overlapping factors on the individual, social and systemic levels in the pre-conception and prenatal phases. For example, a systematic review of qualitative studies on the context of maternal alcohol use found that among the most common reasons for alcohol use during pregnancy are: 1) a lack of awareness of the associated harms, including FASD; 2) a belief that low quantities of alcohol, or certain types of alcohol (e.g., beer vs. spirits) may be okay; 3) unplanned pregnancies, resulting in "typical" alcohol use levels; 4) the surrounding opinions of family and friends suggesting alcohol use may be okay; and 5) misinformation from health practitioners (30). In general, barriers and facilitators of alcohol use during pregnancy include: trauma and other stressors, social relationships and norms; stigma; alcohol information and messaging; and access to trusted equitable care and essential resources (31).

Mental health and substance use preceding pregnancy are also important to examine. For example, one-third of the women who reported alcohol use in pregnancy in Ontario (2015-2018) had a pre-existing substance use or mental health concern that was reported or diagnosed (19). This history was found to be important in predicting binge or weekly drinking during pregnancy and associated adverse outcomes at birth (19). In particular, pre-existing addiction increased the odds of binge or weekly drinking by six times when it was reported as the sole current/pre-existing mental health concern or as the mental health concern in addition to another mental health disorder (19).

Stigma surrounding substance use dependence can be a major barrier to women seeking substance use treatment, and unfortunately, this can impede the maternal and fetal benefits that would be derived from abstinence from alcohol and other substances during pregnancy. As well,

alcohol use during pregnancy may be associated with a delayed onset of prenatal care, as found in a Canadian study examining the timing of the first prenatal ultrasound (32). The stigma around alcohol and substance use during pregnancy can impact the willingness of pregnant women to engage in conversations with their care providers about the associated risks, and vice versa.

In addition to this, there are important systemic factors, including the experiences of racism, discrimination, intergenerational trauma, stigma, poverty, housing and/or food insecurity, and limited access to health care and education (33-35) . In Canada, this is especially relevant to people from First Nations, Inuit and Metis communities. Many youths in First Nations suffer from mental health issues, which rooted in multi-generational trauma due to colonization and racism. According to the most recent report by Sioux Lookout First Nations Health Authority (2018), the rate of suicide among youth from Sioux Lookout area First Nations increase by 26% and in 2012 was 40 times higher than the Ontario average (36). The rate of emergency department visits for mental health issues, including depression, anxiety, self-harm, and other psychiatric disorders, increased by 123% and was about 5 times greater than Ontario youth in the general population between 2012 and 2016 (36). Furthermore, the rate of hospitalization for youth increased by 67% during this time. The teenage pregnancy rate among Sioux Lookout area First Nations was reported to be 8 times higher than the Ontario average in 2015-2016 (36). These recent findings highlight that compared to the general population of Ontario, youth from First Nations communities tend to fare worse with respect to important mental health indicators. The proposed project will work to achieve equity in access to quality health services and other underlying determinants of health of First Nations children and youth through health education.

Attitudes toward alcohol use in general, in addition to current drinking behaviour, are predictors of alcohol consumption in pregnancy. In Ontario, approximately 77% of women of childbearing age indicate past-year alcohol consumption (37), and recent data indicate that the COVID-19 pandemic has further increased alcohol use among women of childbearing age (38). One systematic review on the predictors of drinking alcohol during pregnancy identified experiences of abuse and violence as being important predictors of consumption (39). Additionally, education level, marital status and unemployment status were found to be predictive in some studies, while social class and income were inconsistent. While immigrant status is actually associated with less alcohol consumption during pregnancy (39, 40), Canadian women are more likely to drink alcohol during pregnancy if they have a partner, are current smokers, and if they have negative attitudes toward the current pregnancy. The risk of having a child with FASD is escalated by the fact that up to 44% of pregnancies are unplanned (41). Women's alcohol use in pregnancy is influenced by socio-economic status, mental health history, their own FASD status, access to prenatal care, access to housing and education, and experiences of intimate partner violence, stigma, discrimination, and food insecurity (39, 42-44).

In light of recent policy changes, population health events and their effects on mental health and substance use, we must examine alcohol use among childbearing women to identify prevention opportunities that have the capacity to improve maternal and fetal health. Prevention initiatives should take into account the various identified psychological, social, systemic and political factors affecting alcohol use in general, and the needs of a diverse group of women of childbearing age in Canada.

2.2 Fetal Alcohol Spectrum Disorder (FASD)

FASD is a serious, chronic, systemic disease characterized by the central nervous system damage and physical deficits caused by prenatal alcohol exposure (PAE), which subsequently lead to a wide range of permanent and lifelong health consequences. The complexity and chronicity of FASD impacts both the individual and their family, and requires assistance from a wide range of services including health, community, remedial education and many others. As such, FASD has a huge economic and societal impact as those affected suffer a lifelong chronic disability and may require lifelong support (45-47). The annual costs associated with FASD in Canada have been estimated to range from $1.8 billion to $5.3 billion (48), which includes both direct and indirect costs of FASD on various service systems, including the health care, children in care, correctional and educational service systems.

The burden of illness and economic cost associated with FASD are significant and heightened by the fact that individuals exposed prenatally to alcohol are at greater risk of having co-morbid conditions and premature mortality than individuals without PAE (49). A systematic review by Popova and colleagues (2016) identified over 400 co-morbid conditions that occur among individuals with FASD; these disease conditions span across 18 (out of 22) chapters of the International Classification of Diseases, tenth revision (ICD-10) (50). Moreover, the results, from 183 meta-analyses, are reflective of the well-documented central nervous system damage caused by prenatal alcohol exposure, with specific conditions within the language, auditory, visual, and mental and behavioural domains having a pooled prevalence between 50%–91% among individuals with Fetal Alcohol Syndrome (FAS) (50). Other co-morbid chronic conditions found to occur are congenital malformations, deformities and chromosomal abnormalities, cancer, cardiovascular diseases, genitourinary diseases, malformations and deformities of the musculoskeletal system, and many others (10, 50-52). Individuals with FASD are likely to experience subsequent adverse outcomes later in life, such as mental health problems, disrupted school experience (suspension, expulsion and/or drop-out), poor academic achievement and school failure, involvement with the law, alcohol and other drug problems, problems with employment, and dependent living (53, 54).

The estimated prevalence of FASD ranges from 2-4% in Canada, among the general population (55, 56), and unfortunately, the vast majority of individuals in Canada who are living with FASD are undiagnosed or misdiagnosed (57). There have been some studies suggesting the prevalence of FASD among Indigenous sub-populations in Canada being higher. For example, a systematic review and meta-analysis found that the pooled prevalence of FAS and FASD among the First Nations population was estimated to be much higher - 41.6 per 1000 (95% CI: 0.0-133.4 per 1,000) and 86.8 per 1000 (95% CI: 0.0-198.7 per 1,000), respectively, in Canada (23). It must be acknowledged, however, that these pooled prevalence estimates are based on a limited number of outdated studies with numerous acknowledged methodological limitations such as being conducted in small communities, language barriers and excluding individuals who did not meet the criteria for a diagnosis of full FAS. Conversely, recent data from the First Nations Information Governance Centre (FNIGC), which suggest that only 7% of women from First Nations consume alcohol during pregnancy and under 1% of children in these participating communities had FASD (58). It is important to use a variety of data sources in examining the prevalence of alcohol use during pregnancy and FASD in Indigenous communities.

Furthermore, a few existing epidemiological studies have reported a much higher prevalence of FASD among other subpopulations, such as children in care (59, 60), correctional

populations (61, 62), and people with psychiatric disorders (63, 64). The estimated prevalence of FASD in these special subpopulations was 10-40 times higher compared with the 7.7 per 1000 (95% confidence interval: 4.9-11.7) global FASD prevalence in the general population (65).

It has been estimated that one in every 13 children who were prenatally exposed to alcohol will develop FASD (66). Even relatively low levels of alcohol use during pregnancy can significantly increase the risk of FASD to the child (67, 68). In Canada, approximately 10% of women in the general population (22), and approximately 7% of women in First Nations communities consume alcohol during pregnancy (58); therefore, a considerable proportion of Canadians may be at risk for FASD.

2.3 Preconception prevention education

The prevention of alcohol use in pregnancy is aligned with the World Health Organization (WHO) initiative to prevent chronic diseases (69) and WHO initiative to reduce the harmful use of alcohol globally (70). Remarkably, it has been estimated that preventing one case of FASD incurs only 3% of the costs it would require to provide support services to an individuals with FASD across their lifespan (71). FASD prevention initiatives, therefore, have the potential to reduce disease burden and save service systems considerable costs. In Canada, the most recent public health and obstetric guidelines assert that there is no safe amount, no safe time, and no safe type of alcohol to drink during pregnancy, which is endorsed by FASD researchers and Health Canada (72, 73). Currently, all provinces and territories in Canada have implemented FASD and PAE awareness campaigns, though there is a gap in pre-conception prevention education efforts (74). Conflicting, misleading messages in the media about low-to-moderate alcohol consumption (e.g., wine can be healthy with meals) pose a significant challenge to FASD prevention. While certain youth may have less exposure to such harmful messages in the media, these messages contribute to a cultural understanding of alcohol use in pregnancy and have the potential to influence alcohol use patterns in general and during future pregnancies.

The common public health message in Canada, regarding alcohol consumption during pregnancy, emphasizes there is no safe amount, no safe time and no safe type of alcohol to drink during pregnancy (75). The Centre for Disease Control also endorses complete abstinence, adding that alcohol should be avoided in women who could become, or are trying to become, pregnant. While these messages have a strong evidence base, they are often criticized, and there remains a great deal of uncertainty about the effects of low to moderate alcohol consumption during pregnancy (30, 72, 76). This uncertainty is among the public domain, as well as clinical practice, as evident by a lack of consistent training in this area and implementation of screening for alcohol and substance use in pregnancy by healthcare providers (77-81).

Currently, a number of myths related to FASD and PAE are readily available in Canada. These common misconceptions include uncertainty about the longevity of FASD through the life course, the benefit of receiving a diagnosis, and the severity of FASD diagnoses. Schools are currently under-resourced in terms of professional development for teachers and education and awareness of FASD (82). To address this gap, it is important to provide education practitioner competency in FASD content, providing education to students, and addressing negative stereotypes that may exist, leading to a decrease in stigma.

Individuals with FASD and their mothers experience enormous stigma (83). The experience of being stigmatized often leads to underreporting alcohol consumption during pregnancy, or under-utilization, or delayed prenatal care services (32). Therefore, prevention efforts have important ethical challenges with respect to delivery of messages, but it is important to provide accurate information to empower women who are of childbearing age.

Canadian leaders in FASD prevention have identified conflicting messages about low-to-moderate alcohol consumption during pregnancy in the media, as a barrier to women and practitioners. There is currently a gap in pre-conception initiatives to prevent FASD in Canada (74), as well as a gap in the implementation of specific FASD prevention initiatives for Indigenous communities that target the cultural and historical context relevant to PAE (84).

Targeting adolescents in a pre-conception FASD prevention initiative covers two of the levels of FASD prevention created by PHAC: a) prevention strategies that include dissemination of FASD facts via media campaigns, information sheets and websites; and b) prevention strategies that involve discussions with young women and their support networks about risk associated with alcohol use in pregnancy (70).

Pre-conception prevention education initiatives can be understood theoretically using the Health Belief Model, which posits that by targeting benefits, self-efficacy, threat and perceived barriers, messages will achieve optimal behaviour change (85). The theoretical basis of this model is based on the premise that individuals will take preventative health measures if they believe they are susceptible to the condition and if they believe the condition is related to serious consequences. Additionally, individuals are more likely to follow through with a health action if they believe doing so is associated with positive outcomes, or benefits and they perceive few negative attributes, or barriers, to taking the preventative measure.

Within the Health Belief Model, it is theorized that behavioural change occurs as a result of several social and cognitive determinants of behavior (86), which should be directly targeted by interventions; this has been supported by systematic reviews (87, 88). Interventions based on the HBM have been effective in promoting health behaviours related to addiction, injury prevention and in general capacity to predict behavior (89).

The HBM model has proven effective for a school-based intervention in Sweden targeting HPV prevention in adolescents (89). This randomized control trial (RCT) demonstrated effectiveness of the intervention by an increase in beliefs about the benefits of HPV prevention, in addition to an increase in HPV vaccinations in this diverse population of adolescents. Similarly, a school-based intervention in Iran based on the Health Belief Model, also demonstrated effectiveness in increasing HIV prevention behaviour among male high school students (90). In Thailand, it was found that perceived barriers in school-aged children significantly predicted physical activity, though perceived benefits and cues to action were not as important (91).

The HBM basis for intervention has also proven to be effective in relation to substance use. One study of South Korean adolescents found that consumption of highly caffeinated drinks was significantly predicted by perceived harms and benefits of consumption (92). Likelihood of action was also found to be a significant predictor, and this was measured by a structured questionnaire based on the Health Belief Model, developed specifically for this intervention. Interventions based on the Health Belief Model can also be effective in promoting health-enhancing behaviour long-term, as shown in one study in Iran, which demonstrated effectiveness of a school-based program in promoting behaviours in primary school girls, related to osteoporosis prevention (93). In relation to school-based alcohol use prevention initiatives,

qualitative evidence based on reports of educational staff in the UK delivering a school-based intervention targeting alcohol use, noted that interventions would be most effective if long-term risks of use are discussed (94).

Though not implemented nationally, and lacking evaluation, some schools in Poland have implemented school-based FASD prevention initiatives, such as 2-hour workshops for secondary school students to understand the harmful effects of alcohol consumption during pregnancy (95). In certain schools, teachers choose to implement a prevention program delivering the message of total alcohol abstinence during pregnancy. This complements the concurrent FASD prevention initiatives in Poland in clinical groups, media and on the government level.

Research has shown promising impacts of school-based PAE awareness and FASD prevention initiatives. Multimedia presentations focused on alcohol use and other drug-related effects on fetal development delivered by peers and college students in an educational setting have shown to significantly change middle school and high school students' knowledge of the effects of PAE (96). A systematic literature review of forty school-based projects that targeted alcohol within a school setting revealed that despite the numerous programs available, very few have sufficient evidence for their implementation (97) The authors highlighted the importance of further research to strengthen the evidence base in this area. Another systematic review evaluated the effectiveness of universal school-based prevention programs in reducing alcohol misuse among young people (98). This study revealed that certain psychosocial and developmental prevention programs can be effective, however, the overall quality of the evidence was low. Several studies, which reviewed school-based programs aimed to prevent and reduce alcohol use among youth, highlight the importance of implementing alcohol education programs that are well-designed, grounded in theory, interactive, and age-appropriate (98-100). One meta-analysis concluded that school-based interventions are a valuable tool in addressing adolescent alcohol use, but should be part of broader prevention strategies (101). Several systematic literature reviews and meta-analyses call for more rigorous and longitudinal evaluations of school-based alcohol prevention programs to understand and maximize their sustained impacts (99, 101, 102).

The Scottish Health Promoting Schools Unit indicates that drug education content can show progression through the grades in the following ways: student knowledge becomes more detailed; relevant vocabulary widens; conceptual understanding deepens; ability to see connections and to generalize develops; skills reflect increasing complexity; new knowledge, skills and attitudes not only add to but also enrich previous learning; students' views of supporting others with respect to substance use widens; and appreciation of moral and ethical issues develops (103).

In Canada, there is one school-based program developed by The Simcoe County FASD Committee's 2018 "Fetal Alcohol Spectrum Disorder Lesson Plan", which aimed to educate students about harmful effects of alcohol before and during pregnancy and FASD. However, the lesson plan is not accessible and was not evaluated (104).

In the Canadian context, it is critical to be able to adapt and modify the curriculum to the special sub-populations, to be culturally relevant and appropriate. In one systematic review of FASD and PAE prevention initiatives (including school-based) found them to be largely ineffective for First Nations communities, as cultural and historical context relevant to the First Nations populations, was not addressed (84). Canadian leaders in FASD prevention indicate that public health messaging must be tailored to subgroups, and campaigns targeted at girls and women in the pre-conception period, at the school level, and/or involving face-to-face

discussions with youth (105, 106). Alongside other sectors of the community, schools share an opportunity to contribute to the prevention of FASD and serve as an ideal setting to provide age appropriate education about the consequences of prenatal alcohol and other substance use exposure (105).

School-based alcohol interventions are considered cost-effective as they have the potential to prevent cost related to the negative consequences of harmful drinking. For example, study by Caulkins and colleagues (2004) demonstrated that even small effect sizes in school-based drug prevention programs could result in significant societal savings (107). The study also suggested that implementing such interventions in schools, where many adolescents can be reached, can contribute to improved public health outcomes (107). Addressing alcohol consumption during pregnancy within a prevention initiative involves a number of ethical considerations, and doing so in a First Nations population, requires adaptation and culturally-sensitive approach. Alcohol use during pregnancy in First Nations populations needs to be understood and addressed in the historical and social context of colonization, oppression and inter-generational trauma that characterizes the social and demographic realities of this population. At the same time, viewing alcohol use among the First Nations populations in Canada as a coping mechanism for dealing with past trauma does not address harmful behaviour patterns; this collective experience is multi-faceted and the heterogeneity of First Nations populations must not be overlooked (108). Pregnancy in First Nations women is often a period during which negative stereotypes about First Nations people are reinforced upon them, which not only marginalizes women further, but also implicitly makes judgments about motherhood in First Nations women (33, 72, 109).

2.4 NOFAS Curriculum

The NOFAS school-based FASD Education and Prevention curriculum was developed by the Centers for Disease Control and Prevention (CDC) in 2006, for students in Kindergarten to Grade 12 to provide an age-appropriate, educator-delivered intervention about the consequences of PAE on human development. This was implemented by the National Organization for Fetal Alcohol Syndrome (NOFAS), which has since been renamed to FASD United. This curriculum simultaneously encourages children and youth to be tolerant and accepting of all individuals notwithstanding capabilities or disabilities. The NOFAS curriculum can be implemented in classroom settings without specialized staff training or knowledge. This curriculum teaches students about the risks of alcohol use in pregnancy and the biology and life experiences of individuals with FASD. The NOFAS curriculum is based on allowing students to understand concepts related to health promotion and disease prevention, to enhance their decision-making skills to enhance and advocate for their personal and community health.

In the United States, a total of 27 school systems have implemented one or more modules of the NOFAS curriculum (110) within two or more schools. The implementation of the curriculum involved training over 4,000 educators and staff and providing comprehensive workshops about FASD and use of the curriculum to 21 schools and/or school districts. This represents only a fraction of the dissemination to schools because lesson plans/units were duplicated in some districts (e.g., 180 schools in Utah reproduced the grade 9-12 module). A total of 2,377 curriculum modules or units have been distributed throughout all 50 states, three American Indian tribes and at least 7 countries, including Canada, United Kingdom, Australia,

France, Ireland, New Zealand, and South Africa (96).

In the NOFAS curriculum, middle and high school students are targeted with different objectives, which includes the following 30-45 minute modules and units and used by teachers (without specialized training):

- The "Sixth through Eighth Grade" module employs an anatomical learning approach with an emphasis on the physical affects that alcohol has on the brain.
- The "Ninth through Twelfth Grade" module engages students in decision-making discussions related to alcohol use and pregnancy and presents students with extensive information on FASD and the importance of avoiding alcohol during pregnancy.

2.5 Opportunity for modification of the NOFAS curriculum for school-based FASD prevention in Ontario

The research team of this study identified an opportunity to implement the NOFAS curriculum in Ontario, Canada in an innovative manner well-suited to culturally adapt, implement and evaluate this curriculum in an effort to address PAE and FASD from a prevention perspective, targeting students in the pre-conception phase.

Currently, Ontario schools have varying formats of implementation for substance use and sexual health education; this pilot study sought to combine them in a meaningful way, connecting it to birth and child outcomes for students. The public health recommendation of abstinence from alcohol during pregnancy tends to focus solely on child outcomes, which is a criticism of this approach (111). In this pilot study, students learned about the harmful effects of alcohol use to their own health, which is intended to allow them to make a personal connection to alcohol as a teratogen for a future pregnancy. This intervention also has a long-term goal of increasing students' likelihood of following the recommended course of action, and abstaining from alcohol while pregnant or breastfeeding in future, beyond the timeframe of this project. The research team of this study sought to uniquely adapt the curriculum to address the needs of individual school populations in Ontario in a manner designed to complement existing teacher guidelines for providing education about alcohol and health. This project was the first to provide accurate, culturally-appropriate, up-to-date scientific and public health information on PAE and FASD to diverse school populations, so as to address common misconceptions regarding alcohol consumption in general and during pregnancy.

The research team of this study identified opportunities to fill in gaps in the implementation and evaluation literature by conducting this pilot study with an adapted version of the NOFAS curriculum.

1. **Implementation**:
    a. **Address limitations of previous prevention initiatives**: Previous studies of FASD and PAE prevention initiatives have suggested that content may have heteronormative assumptions and therefore be biased (111, 112). To mitigate any heteronormative bias of this curriculum and to reach as many students as possible with the content, the steering committee ensured that the curriculum was adapted to address the needs of a diverse group of students, including those who identify as LGBTQ. It is unknown if all female students who participated in the project will become pregnant at some point in their future, and/or if remaining students will be a partner to someone who

will become pregnant. Even for students for whom this does not apply, the curriculum was designed to still be relevant later in life, as social norms and cues from peers are major predictors of alcohol use during pregnancy (39). One of the intended long-term effects of the curriculum included increased awareness among peer circles and communities, of the harms associated with alcohol-exposed pregnancies.

b. **Include updated, Canadian data and perspectives**: The NOFAS curriculum, originally developed in 2006, needed to be updated with important statistics and perspectives from studies conducted in the Canadian setting, in order to be suitable for middle and high school students in Ontario. This included findings from epidemiological studies on the prevalence of alcohol use in general and during pregnancy, and related alcohol-attributable harms. The revised content also incorporated recent Canadian research on FASD including its associated comorbidities and costs, along with qualitative insights into the contextual factors influencing alcohol use in pregnancy.

c. **Convert the NOFAS curriculum into a multi-media, turnkey lesson plan**: The NOFAS curriculum original form is comprised of paper resources, physical learning objects (e.g., "FAS brain" model passed around to students), learning handouts with an outdated video file focusing on the legal aspect of alcohol use in pregnancy (1999). Some teacher preparation is required for this teacher-led curriculum, and a total of five teacher resources exist for teachers to complement their efforts in delivering this curriculum. The research team of this study had identified an opportunity to create an adapted curriculum that requires minimal teacher preparation (e.g., turnkey) and minimal administrative burden. This was chosen so as to minimize variation in the delivery of the curriculum and to ensure consistent delivery of the FASD prevention education messaging.

d. **Include a module that focuses on alcohol use in general**: Recent systematic reviews and studies examining risk factors for alcohol use in pregnancy indicate that attitudes toward alcohol use in general, and peer attitudes and alcohol use behaviours, do influence alcohol use in pregnancy later in life (39). As such, an opportunity was identified by the research team to include a component in the modified curriculum which would teach students about the risks of alcohol and substance use in general, including the impacts of underage drinking on wholistic wellness and contextual factors affecting substance use on the individual and systemic levels. This action also worked to address previously identified limitations, including that the curriculum had a heteronormative assumption that students are all cis-gendered and plan on having children later in life. Including a focus on alcohol and substance use in general made the content more relevant to middle- and high school-aged students who are in the age group associated with initiation of alcohol use and intimate relationships wherein pregnancy may be a possible outcome.

e. **Incorporate the Health Belief Model (HBM)** in the adapted FASD prevention education curriculum to affect student motivation for FASD prevention and predicted substance use behaviour later in life. The research had identified numerous successful prevention education initiatives that addressed substance use and reproductive health using the HBM to affect student change. As such, the HBM was incorporated into the adapted curriculum and the team addressed all four components of the HBM, including information about the prevalence of FASD, as well as the life course of

individuals with FASD. By presenting information about the harms associated with prenatal alcohol exposure, the curriculum intended to enforce the Canadian public health message of "no safe type, amount or time for alcohol consumption".

f. **Create a separate version of the FASD prevention education lesson plan for schools serving primarily First Nations students**: As students from First Nations communities in Ontario may experience substance use in a different context and within different cultural understandings, the research team had identified an opportunity to make a separate lesson plan for First Nations students. This included First Nations teachings on wholistic wellness and the importance of cultural activities and spiritual guidance on the prevention of harmful behaviours, including underage alcohol use and alcohol use during pregnancy.

g. **Conduct implementation in a controlled manner**: Currently, the extent of FASD prevention education is unknown in Ontario, as well as the extent of implementation of the original NOFAS curriculum, and when/where NOFAS curriculum could have been implemented in the province. FASD is mentioned the 2015 Ontario Physical Health & Education Curriculum for Grades 6-8 and Grades 9-12, as well as the Biology curriculum for these grade levels. FASD is mentioned as a prompt, and no specific learning activity or objective outlined for educators teaching students in these classes. The research team had, therefore, identified an opportunity to implement an adapted FASD prevention education curriculum in a controlled manner in Ontario in which the extent, or fidelity, of the intervention was studied.

h. **Include more strengths-based language on focus on anti-stigma related to PAE/FASD**: Currently, a component of the original NOFAS curriculum, which encourages inclusivity and acceptance of different abilities among students, is designed for students in Kindergarten to Grade 2. The research team adapted the curriculum in a manner such that this component was modified to be age-appropriate for the targeted grades 7-12 of this pilot project, in a format that the Steering Committee decided was most effective. With the inclusion of this strengths-based component, the adapted curriculum also addressed stigma against individuals with FASD and their families.

2. **Evaluation**:

a. **Gap in knowledge of the effectiveness of the curriculum**: Prior to the initiation of this pilot project, the research team sought findings on the effectiveness of the original NOFAS curriculum, but these were unpublished. Obtained from a NOFAS source, the research team was informed that the content and implementation of this curriculum have proven to be effective in schools that have received the NOFAS curriculum. The pre-test and post-test results revealed an increase of 27% in content knowledge among grade 10 students. However, the effectiveness of the curriculum for students in other grades was unknown, and the exact timing and location of this evaluation is also unknown. The current pilot project sought to thoroughly evaluate the adapted FASD prevention education curriculum in multiple grades (7-12) and to publish the results.

b. **Inclusion of control groups**: This previous evaluation of the original NOFAS curriculum did not utilize a control group of students who had not participated in the NOFAS curriculum. As such, the research team had identified a gap and opportunity to compare pre-test and post-test findings for students in experimental (intervention;

adapted FASD prevention education curriculum) and control (no intervention) groups, to isolate the effect of the curriculum itself.

2.6 Objectives of the FASD Prevention School-based Project

This school-based project is innovative, the first to address PAE and FASD from a prevention perspective, targeting students in the pre-conception phase and filling in implementation and evaluation gaps. Currently, Ontario schools have varying formats of implementation for substance use and sexual health education; this pilot study sought to combine them in a meaningful way, connecting it to birth and child outcomes as well. In this pilot study, students learned about the harmful effects of alcohol use to their own health, which was intended to allow them to make a personal connection to alcohol as a teratogen for a future pregnancy. This was further intended to increase their likelihood of following the recommended course of action, and abstaining from alcohol while pregnant or breastfeeding in future. The NOFAS curriculum was uniquely adapted to address the needs of individual school populations and to complement existing teacher guidelines for providing education about alcohol and health. This pilot project is the first to provide accurate, culturally-appropriate, up-to-date information on PAE and FASD to diverse school populations, so as to address common misconceptions regarding alcohol consumption during pregnancy.

The overarching objective of this pilot project was to modify, culturally adapt, implement and evaluate the efficacy of the original *2006 NOFAS school-based FASD Education and Prevention curriculum* in select schools in urban, rural and First Nations communities of Ontario. The adapted FASD prevention education curriculum complemented the provincial Ontario Ministry of Education curriculum for Grades 7-12 in health and physical education, family studies, and biology. The implementation of this curriculum sought to inform students about the risks associated with alcohol use in pregnancy and to prevent alcohol use in pregnancy later in life, and therefore, new cases of FASD.

The implementation of this pilot project was, therefore, dependent on successful engagement and partnership with the following:

1. **First Nations partners**: These partners, including Knowledge Keepers, Elders and First Nations researchers at CAMH and external researchers, were essential in the cultural adaptation of the curriculum, implementation and evaluation of the results pertaining to students from First Nations communities.
2. **School administrators and educators**: Popova and team's pre-existing relationship with school boards and schools across Ontario (based on the previously conducted FASD prevalence study in the Greater Toronto Area; Popova et al., 2019 (55)) facilitated applications to School Boards for curriculum modification. School administrators and educators were essential in providing ethics reviews of the turnkey lesson plans and associated materials, as well as the implementation of the lesson plans and student surveys.
3. **Project Steering Committee**: A diverse group of knowledge users (KUs) and professionals participated on the Steering Committee, which guided all aspects of the project, especially curriculum adaptation.

This school-based, FASD prevention education pilot project had the following **specific objectives** (2019-2024):

1. Prepare, modify, and culturally adapt the original NOFAS curriculum for implementation in twelve selected Ontario schools serving urban, rural and First Nations communities (four schools in each category);
2. Implement the adapted FASD prevention education curriculum in select Ontario schools to increase awareness among students in grades 7-12, of the risks of prenatal alcohol and other substance use to develop their understanding of FASD and other health consequences;
3. To encourage children and youth participating in the FASD prevention education curriculum to be tolerant and accepting of all individuals notwithstanding capabilities or disabilities, including individuals with FASD. This was the intent of a select module in the curriculum that will be modified before implementation, so as to be age-appropriate for each grade and to decrease stigma against individuals with FASD and other developmental disabilities;
4. To evaluate the effectiveness of the FASD prevention education curriculum and to fill an information gap in the FASD prevention research literature by publishing an evaluation (process and outcome) of the FASD prevention education curriculum piloted in Ontario, Canada; and,
5. To develop a tool kit guiding the culturally sensitive adaptation and implementation of the FASD prevention education curriculum for provincial and territorial Ministries of Education (if found effective). This current report serves this purpose. It provides an overview of all aspects of the project, which can guide further implementation of the curriculum in additional schools and jurisdictions.

Within the timeframe of this project, it was possible to evaluate short-term outcomes only, but the students' increased awareness of FASD and PAE, are hypothesized to remain or even increase following measurement (96). This evidence-informed intervention posits that the school-based program will have long-term effects on the students reached, beyond that, which could not be measured in the 4-year timeframe.

The completion of the proposed project in Ontario serves as a reference point for implementation on a national level in Canada, by providing the following:

- Time estimates for adaptation of curriculum for various school settings;
- Directions on implementing the adapted FASD prevention education curriculum into schools of various populations (urban, rural and First Nations);
- Time estimates for implementing various adaptations of the curriculum (e.g., in a remote, predominantly First Nation school);
- Evaluations of the effectiveness of the adapted FASD prevention education curriculum as it pertains to schools serving middle- and high school-aged students in grades 7-12 from urban, rural and First Nations communities; and
- A process evaluation to demonstrate the fidelity, or consistency, of the implementation of the FASD prevention education curriculum (i.e., intervention).

These data were collected from student and teachers in an attempt to achieve the long-term outcomes of this project, including:

1. Increased capacity for the Ministries of Education to implement prenatal alcohol and other substance use prevention programs:
2. Increased awareness of harmful effects of alcohol and other substance consumption during pregnancy among target audiences
3. The Public Health Agency of Canada and provincial/territorial Ministries of Education will have access to an evidence-based PAE prevention initiative adapted for the Canadian context, and will understand the feasibility of implementing the initiative in urban, rural and First Nations schools;
4. Increase in Canadian research contributions to the prevention science literature; and
5. Increased capacity in Canada to address PAE and FASD by publishing an evaluation of a FASD prevention education initiative implemented in Ontario and developing tools and resources to facilitate educating children and youth about the risks of alcohol and other drug use during pregnancy for widespread dissemination.

With the developed FASD prevention education curriculum used in this intervention, the research team expected an increase in the students' knowledge of the presentation information. One study evaluated the results of a similar educational initiative in the US, which included a multi-media presentation, similar to the NOFAS curriculum, and found that students' knowledge increased further, after the post-test measurement (96). As this was a pre-conception prevention initiative, this program was expected to first target health-knowledge, beliefs and self-efficacy related to decision-making and PAE, before affecting health behaviours in future pregnancies.

Through piloting an evidence-based FASD prevention education initiative and conducting process and outcome evaluations to inform a tool kit intended to facilitate scale up, the predicted impact of the proposed project was to improve children and youth's awareness of the consequences of prenatal alcohol and other substance use, to encourage children and youth to be tolerant and accepting of all individuals notwithstanding capabilities or disabilities, and to prevent PAE. This was theorized to be connected to two long-term effects beyond the scope of this project, including: 1) a decrease in alcohol-exposed pregnancies and thus, a decrease in new cases of FASD (i.e., decreased incidence); and 2) a reduction in stigma against people with FASD and their families.

3.0 METHODOLOGY

3.1 Ethics reviews and approvals

This research project was sensitive to the unique needs of Northern Ontario communities and included a multidisciplinary effort among epidemiologists, clinicians, and social scientists to implement the project in a culturally appropriate manner. This research project was undertaken in accordance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans (TCPS)*, Chapter 9: Research Involving the First Nations, Inuit and Métis Peoples of Canada. In addition, the *Canadian Institutes of Health Research (CIHR) Guidelines for Health Research Involving Aboriginal People* (113) were influential in shaping this research. This study was also carried out in accordance with the *Good Clinical Practice (GCP)* 1997 guideline.

Upon receipt of funding, the research team applied for ethics approval, using the original NOFAS curriculum materials, including the student activities, teacher resources, and pre-test and post-test survey instruments. As materials continued to be modified for the adapted FASD prevention education curriculum, they were resubmitted for ethics review and approval annually and as needed (per modification). This study was approved by the CAMH Research Ethics Board (2019-2024).

Once the lesson plan and associated materials were approved by the CAMH REB and finalized by the Project Steering Committee, ethics applications to several school boards were finalized and submitted. This study received ethics approvals from the Rainbow District School Board, Sudbury Catholic District School Board, Toronto District School Board, Halton District School Board, Hamilton-Wentworth District School Board and the Peel District School Board. Collectively, these school boards represented students from First Nations, urban and rural communities, as guided by the Project Steering Committee and First Nations partners.

3.2 Steering committee and partnerships

Established partnerships and trust relationships were formed during the project and will remain between project partners and collaborating organizations and committees past the funded project timeframe. These connections will support further research in FASD, implementation of similar programs, or even replication of this proposed pilot study using the FASD prevention education curriculum. This network will facilitate increased awareness of PAE and FASD on both the provincial and national levels within Canada.

By engaging with First Nations communities, school principals and First Nations partners, this facilitated the creation of curriculum content within the adapted FASD prevention education curriculum that was designed specifically to address stigma related to FASD and PAE in the First Nations population. Knowledge users were incorporated into the creation/adaptation of knowledge mobilization activities for First Nations school populations, with the intent to make the implemented FASD prevention education curriculum as culturally sensitive and relevant as possible.

3.2.1 Steering Committee

Upon confirmation of receipt of funding, the research team were guided by the PHAC to connect with potential Steering Committee members for this school-based project, which were identified based on their previous experience in the field of FASD, PAE prevention, First Nations work in substance use prevention, harm reduction, and their work on similar projects for PHAC and CAMH.

Following an invitation process, a total list of fourteen Steering Committee members were finalized. These Steering Committee members included a diverse group of professionals, including social workers, educators, Knowledge Keepers, Elders, women's substance use researchers, harm reduction workers and individuals with lived/living experience of alcohol use during pregnancy, prenatal substance exposure and/or FASD. Steering committee membership includes individuals holding a wealth of expertise, including: living experience with FASD, adult and youth counselling, social services, health education, and research. It was deemed important

for the curriculum to be designed to complement existing guidelines and professional development for teachers, and from the perspective of professionals who may be part of the implementation of the program.

The Steering Committee informed the project through expert review of the NOFAS curriculum and review of the implementation and evaluation methods and materials. Steering Committee Members gathered for an inaugural project meeting in 2020 wherein it was agreed that members will apply their knowledge and experience to:

1. inform curriculum modification, cultural adaptation, delivery and evaluation,
2. create meaningful indicators, measurements, and culturally-appropriate, evidence-based process and outcome evaluations, and
3. advise and approve:
    a. data management plan,
    b. implementation tool kit and other knowledge products and
    c. dissemination strategy.

Steering committee members committed to supporting this project throughout the funding period, from Summer, 2019 – August 2024. Specific Steering Committee roles and responsibilities included:

- Approval of the steering committee Terms of Reference;
- Participation in steering committee meetings (one in-person/teleconferences) to:
    - create an implementation and evaluation plan;
    - adapt curriculum to students in Grades 7-12; and
    - develop a module that encourages children and youth to be tolerant and accepting of all individuals notwithstanding capabilities or disabilities, including individuals with FASD.
- To advise on the implementation of the curriculum modules;
- Review the effectiveness of initial implementation and refine implementation plan, as needed;
- Review and discuss the results of process and outcome evaluations;
- Advise the development of an implementation tool kit from to inform replicability of the PAE/FASD prevention initiative; and
- Review and approve knowledge mobilization plan and dissemination strategy.

In the first two Project Years, the Steering Committee met quarterly via teleconference and once in-person (due to the COVID-19 pandemic) in order to adapt the curriculum and co-develop the project implementation, evaluation and analysis plans.

As an agreed upon Term of Reference, Steering committee members committed to not disclosing or publicizing any information related to the work of the committee including the content of discussions, advice or recommendations without prior authorization from the committee and/or the Primary Investigator, Dr. Popova. This including keeping the adapted curriculum and associated materials confidential, without using it in education or prevention settings.

A decision-making process was also agreed upon, including the concept that decisions shall be made by voting members who will have the option to situate their decision on a scale that allows for an opinion to be expressed more clearly than voting “for” or “against” a decision.

The decision-making model that was used provided the opportunity to share a perspective using the following six levels:

1. Fully support
2. Support with reservations
3. Acceptable
4. Will not block it
5. Need more information or more discussion
6. No; cannot accept it

If all members voted at level #4 or above, consensus had been reached. If one or more members voted at levels 2, 3 or 4, they had the option of explaining their reservations to their fellow committee members. If one or more members voted at a level 5, they had an obligation to explain what information or discussion they required from the committee. If one or more members voted at level 6, they were asked to suggest solutions.

Lastly, general principles were agreed upon in the process by all the participating Steering Committee Members, including:

- During the cultural adaptation, modification, implementation and evaluation processes, all steering committee and community of practice members discussed and prioritized the need to appreciate and give equal consideration to First Nation and non-First Nation Ways of Knowing. The intention was to mitigate the risk that one system of knowledge dominates or undermines the contributions of another.
- When findings pertaining to the overall project were analyzed and disseminated, the schools serving students from First Nations communities were not be separated visually or verbally in a way that would be stigmatizing or places emphasis on cultural differences. First Nation community Leadership and/or delegates directed the use of collected information to ensure community benefit.

Similar interventions using the HBM and targeting substance use and/or reproductive behaviours in students have also proven to be effective in increasing content knowledge and health-enhancing behaviours among students. The steering committee informed the adaptation of the curriculum to create meaningful indicators, measurements, and culturally-appropriate, evidence-based process and outcome evaluations. The tool kit captures the tracked progress of the adaptation, implementation and evaluation of the curriculum, on grade level and school category.

The Steering Committee contributed research and expertise necessary for the project team to form necessary partnerships, to adapt, modify, implement and evaluate the FASD prevention education curriculum to address the specific needs of each school. This included understanding the social and demographic profile of students, socio-economic status, substance use patterns, prevalence of mental health problems, pregnancy rates, and overall risk behaviour within each school. Preliminary research conducted in specific schools and communities, in addition to thorough consultation with all Steering Committee members, allowed for appropriate design and adaptation of the FASD prevention education curriculum.

3.2.2 First Nations partners

Essential in this project were the First Nations partners who participated in the consultations regarding the FASD prevention education curriculum adaptation and implementation:

1. Shkaabe Makwa, CAMH; Implementation and Research Specialists guided the cultural adaptation of the FASD prevention education curriculum for students in First Nations communities in Ontario, providing important content, messaging and imagery in line with holistic wellness and the Seven Grandfather Teachings. Shkaabe Makwa was also essential in guiding outreach to schools deemed to be serving First Nations students in Ontario, and provided direction for which school boards and schools to invite accordingly. The research team worked with the First Nations advisory team throughout each stage of this research project: FASD prevention education curriculum cultural adaptation, participant recruitment, data collection, analysis, interpretation, and dissemination of the results.
2. Berens River First Nation: Berens River provided support to the project in the initial proposal development stages. The Chief Jacob Berens Mino-Ayaawin Centre and the Berens River School have organized health promotion activities focused on increasing awareness of the risks associated with prenatal alcohol and other drug use.
3. Canupawakpa Dakota Nation Health Centre: This Centre provided support to the project in the initial proposal development stages. Health professionals within the Canupawakpa Dakota Nation Health Centre were interested in participating in this project which involves partnering with CAMH and other project partners on: reviewing the FASD prevention education curriculum; deter mining its cultural relevance to students living in Canupawakpa Dakota Nation, advising on required cultural adaptations for Indigenous audiences; and advising on the culturally-sensitive delivery of the FASD prevention education curriculum (with any required adaptations).

3.2.3 School administrators and educators

School administrators, principals, educators and the school boards' external research review committees were essential in providing ethics reviews of the turnkey lesson plans and associated materials, as well as the implementation of the lesson plans and student surveys. The research team was in constant correspondence with school boards and their ethics review committees who reviewed applications for external research projects to be conducted in schools. External research review committees provided important guidance for modification of the materials within each school board, as needed. Education administrators and/or school principals were also essential in tailoring implementation for each school and in providing additional data about the demographic profile of each school (e.g., academic drop-out rate, current school dynamics, rates of substance use and unplanned pregnancy; proportion of students with First Nations identity, etc.). Engaging with education administrators also allowed for the development of connections within various school boards that will facilitate connection to the Ministry of Education beyond the scope of this project, contributing to the project's sustainability as an FASD prevention education initiative.

3.3 Curriculum adaptation

3.3.1 Adaptation process

The adaptation of the original NOFAS curriculum involved an iterative process led by the research team and Shkaabe Makwa, spanning across one year and nine months (January 2020 – September 2021). This process occurred in several overlapping phases, in which the team also collaborated with the Project Steering Committee.

1. Content review of the original NOFAS curriculum with the research team and Steering Committee. The Steering Committee met in one large group at the first project meeting (February 2020) as well as in sub-groups virtually during the COVID-19 pandemic. Members were assigned to review the contents individually and as a group and to offer suggestions for improvement and potential opportunities for insertion of more culturally-appropriate, relevant messaging and multi-media.
2. Creation of adapted FASD prevention education curriculum, which resulted in two FASD prevention turnkey lesson plans. Over a process of six months, the research team worked collaboratively with Shkaabe Makwa to put together a multi-media PowerPoint presentation for 1) students in rural and urban communities (i.e., "mainstream") (Appendix B); and 2) students from First Nations communities (Appendix D). This was an iterative process of weekly meetings of discussing and editing content, as well as researching for new content, video media and images.
3. Narration of the two FASD prevention turnkey lesson plans. Over the course of six months, a script was created for each version of the turnkey lesson plans, such that each slide would have narration for its content, and the PowerPoint files could be turned into movie files for classes to use in the intervention. Two narrators were each assigned to one version. The narrator for the First Nations version incorporated their own cultural teachings to the contents of the narration script, providing insights on Anishnaabek teachings related to cultural activities, healthy living and the importance of family.

3.3.2 Adaptation principles and products

Several general principles guided the cultural adaptation of the two versions of the FASD prevention education curriculum.

1. The lessons had to be "turn-key", meaning they would not require any teacher preparation, and the teacher would simply have to be responsible for pressing play on a video file and keeping track of where students left off from the previous session. Teacher Guides, however, were produced to provide extra insight and guidance on the lesson plan, should teachers require it as a reference. These Guides: one for mainstream schools (Appendix C) and one for First Nation Schools (Appendix E) also included extra information and resources, should the teachers be interested in enhancing their education practitioner competency in FASD content.
2. The inclusion of a Unit 1: Impacts of alcohol use on wellness, which provided important content on the risks of alcohol and substance use in general, including alcohol-attributable harms such as carcinogenic effects and the impacts of alcohol use on the

developing brain. Alcohol use was also discussed in light of risk behaviour and long-term impacts. Myths associated with alcohol use (e.g., "wine is healthy") were disputed in this Unit and important videos were included to offer students ways to turn alcohol down if it is offered to them, including potential responses and alternative ways to have fun.

3. In general, YouTube videos were integrated as much as possible, as well as discussion questions for students that offered teacher an opportunity to pause the video file and discuss with the students as a class. The lesson plans were designed to be as interactive as possible. The Power Point Presentation slides were designed to be engaging, with maximum use of bright colours and relevant imagery (e.g., a woman saying "no" to alcohol).
4. The FASD prevention messaging in the lesson plan was to outline the PHAC message of "no safe time, type or amount of alcohol during pregnancy". Students were informed that the best course of action is to avoid alcohol use when pregnant, at risk of becoming pregnant, or while breastfeeding. The proposed project aimed to share the public health message of the Public Health Agency of Canada and the Canadian Centre on Substance Use and Addiction: "If you are pregnant or planning to become pregnant, the safest choice is to not drink alcohol. There is no known safe amount of alcohol to consume in pregnancy or while trying to get pregnant".
5. The risks of alcohol use in pregnancy were discussed in light of potential harms to the mother and child, including a Canadian YouTube video introduction to what FASD is. Students were to learn about the associated comorbidities and adverse health and social outcomes experienced by individuals living with FASD. The most recent Canadian statistics and findings were presented. Students would learn that FASD is prevalent, and largely misdiagnosed or undiagnosed.
6. The lesson plans were to provide a strong emphasis a shared responsibility to prevent FASD. Evidence-based support strategies (e.g., couples staying sober together; not asking women why they're not drinking, etc.) were shared with students as strategies to prevent alcohol use in pregnancy and new cases of FASD, later in life. There was messaging to indicate that FASD affects everyone, including affected individuals, their families and surrounding communities.
7. Most importantly, the lesson plans were to emphasize the positive experiences of individuals with FASD and the overwhelming capacity of individuals with FASD to reach their full potential if met with FASD-informed, non-stigmatizing supports, circles and services. Media was included to emphasize this, such as the Red Shoes Rock campaign, and a collage of words indicated to be strengths of individuals with FASD (46). With respect to the First Nations version of the lesson plan only, the content had to incorporate as much relevant cultural messaging and imagery as possible, while sticking to the general content structure of the program.

As a final result, two versions of the FASD prevention education curriculum were developed:

- One version for mainstream (i.e., urban and rural) schools, 3-4 hours for implementation. The same FASD prevention education curriculum was used for both middle and high school students participating in the intervention.
- One version for schools serving students from First Nations communities, 3-4 hours for implementation. The same FASD prevention education curriculum was used for both middle and high school students participating in the intervention.

3.4 School participation and study design

Twelve schools in Ontario (four urban, four rural, and four First Nations) were selected to participate in the study. Schools from across Ontario were approached to ensure diverse representation from urban, rural and First Nations communities. School from urban and rural areas were selected based on the geographic location of the participating schools and consultation with the principals and other education administrators.

Among the schools selected, six were middle schools (Grades 7 and 8) and six high schools (Grades 9, 10, 11, and 12). The intervention schools implemented the FASD prevention education curriculum (i.e., relevant turnkey lesson plan; mainstream or First Nations) and the comparison schools implemented the default provincial curriculum for the class (i.e., no change to the usual course content). Schools were selected based on their willingness and capacity to participate in this project.

This FASD prevention education curriculum, which aims to increase knowledge and awareness about the risks of alcohol use in general and specifically in pregnancy, and thus, prevent PAE and FASD, can be included and complement existing school curriculum for Grades 7-12 in health and physical education, family studies, and biology. As such, these were the classes that were invited to participate within each school. In each selected school, one or more eligible classes from each Grade were selected. With an assumption of an average of 25 students in each class, the research team planned to enroll approximately 300 students from middle schools (150 students in the intervention and 150 students in the control group); and approximately 600 students in high schools (300 students in the intervention and 300 students in the control group). In total, 900 students were expected to participate in the study. Please see Appendix A for a flow diagram of the study.

To evaluate the effectiveness of the program, we implemented a pre-test post-test design. Though we were not be able to evaluate behavioural change (especially not with middle school students), we evaluated core tenets of the Health Belief Model, as well as content knowledge. The evaluation of the effectiveness is based on the assumption that the FASD prevention education curriculum was designed to provide school-aged girls and boys with the adequate resources and information needed to develop the correct understanding about the content and subsequently make informed decisions later in life.

3.5 Survey development

The effectiveness of the FASD prevention education curriculum was measured using quantitative and qualitative data from teacher and student surveys of participating classes in intervention and control conditions. These surveys were modified from the original NOFAS curriculum surveys, which did not include control group surveys, and updated to reflect the revised content in the finalized turnkey lesson plans of the FASD prevention education curriculum used in this project. This content and the corresponding questions were designed with the following intended short-term, medium-term for students participating in the intervention condition. These outcomes are as follows:

The following **short-term and medium-term outcomes** reflect the changes related to increased content knowledge and health beliefs related to alcohol consumption during pregnancy, associated with participating in the curriculum:

- Increased understanding of teratogenic effects of alcohol exposure during pregnancy, including FASD diagnoses;
- Increased understanding of physical effects of alcohol on the brain and how alcohol use affects brain development;
- Increased understanding of severity, or seriousness of PAE;
- Increased understanding of perceived benefits of abstaining from alcohol during pregnancy;
- Changing within-group norms and attitudes related to alcohol and PAE;
- Increase in individuals' perceived self-efficacy to carry out recommended action (abstain from alcohol during pregnancy and support others in doing so); and
- Spreading acquired knowledge within their family and/or community (spill-over effect may occur)

The following **long-term outcomes** reflect the associated behavior changes related to changed health beliefs related to alcohol consumption during pregnancy, which are connected to the short-term and medium-term outcomes theoretically, though not measured in this project:

- Increased capacity for conversations about alcohol use in general and during pregnancy;
- Increased knowledge of the scope of information and resources available on PAE and FASD;
- Self-empowerment in decision-making regarding abstinence from alcohol and other substances during pregnancy;
- Increased willingness to have alcohol-free pregnancies later in life;
- Increased capacity to support alcohol-free pregnancies in their communities, later in life;
- Increased rates of alcohol abstention during pregnancies later in life; and
- Decreased rate of new FASD cases in children resulting from those pregnancies.

Student and teacher surveys were developed by the research team and in collaboration with the Project Steering Committee and Shkaabe Makwa to measure content knowledge and health beliefs associated with alcohol use in pregnancy and FASD. These were based on the content in the two lesson plans and the theorized short-term, medium-term and long-term outcomes associated with participating in this project. The surveys were designed as follows:

1. **Pre-test student survey (intervention, control; all grades)**, which collected data on:
    a. students' grade level
    b. gender identity
    c. content knowledge about alcohol use in general (carcinogen, teratogen, harmful if consumed by youth with bodies and brains still in development)
    d. beliefs about alcohol being safe for consumption during pregnancy in different amounts, forms (e.g., wine vs. spirits) and at different times of the pregnancy (e.g., first trimester only vs. all)
    e. previous knowledge of FASD (if any) and sources of information
    f. specific content knowledge about FASD as a chronic neurodevelopmental disorder (myths and facts)
2. **Post-test student survey (control; all grades)**, which collected data on:
    a. students' grade level
    b. gender identity

c. content knowledge about alcohol use in general (carcinogen, teratogen, harmful if consumed by youth with bodies and brains still in development)
d. beliefs about alcohol being safe for consumption during pregnancy in different amounts, forms (e.g., wine vs. spirits) and at different times of the pregnancy (e.g., first trimester only vs. all)
e. previous knowledge of FASD (if any) and sources of information
f. specific content knowledge about FASD as a chronic neurodevelopmental disorder (myths and facts)
g. the important of FASD prevention to them
h. the importance of having alcohol-free pregnancies later in life

3. **Post-test student survey (intervention; all grades)**, which collected data on:
    a. students' grade level
    b. gender identity
    c. content knowledge about alcohol use in general (carcinogen, teratogen, harmful if consumed by youth with bodies and brains still in development)
    d. beliefs about alcohol being safe for consumption during pregnancy in different amounts, forms (e.g., wine vs. spirits) and at different times of the pregnancy (e.g., first trimester only vs. all)
    e. previous knowledge of FASD (if any) and sources of information
    f. specific content knowledge about FASD as a chronic neurodevelopmental disorder (myths and facts)
    g. which units (1-3) were they present for in class
    h. which units (1-3) they found most helpful
    i. if they feel more or less knowledgeable about FASD following the lesson plan
    j. the important of FASD prevention to them
    k. the importance of having alcohol-free pregnancies later in life
    l. any suggestions for how to improve the lesson plan
4. **Teacher survey (intervention; all corresponding grades)**, which collected data on:
    a. Grade level taught
    b. Gender identity
    c. Years of teaching experience
    d. Perceived strengths of the lesson plan
    e. Perceived weaknesses of the lesson plan
    f. Suggestions for how to improve the lesson plan
    g. If they would recommend the lesson plan for inclusion in the provincial curriculum

3.6 Measuring fidelity

Measuring fidelity, or consistency of implementation of the intervention (i.e., a process evaluation) was essential as a precursor to conducting the effectiveness evaluation. Measuring fidelity was done in several way:

1. The research team collaborated with the participating teachers so as to schedule the intervention to be conducted during a time wherein most of the class would be present.

For example, we tended to avoid the months of December and June, as they were administratively taxing on teachers and student attendance was partial.
2. Building in questions about attendance to each of the three units, and including this component in the analysis.
3. Where permitted, the Project Coordinator of the research team with teachers' permission, conducted researcher observations virtually via Zoom, during the implementation of the intervention in participating classes.

Fidelity is described narratively in this report (e.g., engagement level in classroom observations) as well as using descriptive statistics for unit completion in each school category (urban; rural; First Nations).

3.7 Measuring effectiveness

This school-based program aimed to provide content knowledge about the effects of alcohol on health with emphasis on pregnancy and FASD, while also providing students with increased motivation to have and support alcohol free pregnancies later in life. An additional intended effect among participating classes was an increased understanding of the symptomatology and life course of individuals with FASD.

To assess the effectiveness of the FASD prevention education curriculum developed for this intervention (i.e., outcome evaluation), student surveys were distributed to participating classes:

1. Pre-test student survey: control and intervention classes (Appendix F);
2. Post-test student survey: control (Appendix G) and intervention (Appendix H) classes; separate versions); and
3. Teacher survey: intervention classes only (Appendix I).

Given the direction provided by the Project Steering Committee, the research team decided to include pre-test and post-test measures in control classes as well. This was done to examine if increases in scores can partially be attributed to testing practice that typically occurs within a repeated measures design. In the intervention arm, the pre-test survey was administered one day prior to the intervention, and the post-test survey was administered on day following the intervention. Distribution of the surveys in control classes was done in a matched timeframe (e.g., 3-4 days apart) and in between these measures, the class would participate in normal student activities as outlined by the teacher. These surveys were the main measure that assessed the effectiveness, or impact of the program, as content knowledge leads to behavioural changes that occur later in life (e.g., adulthood).

The evaluation was conducted on a rolling basis, as the FASD prevention education curriculum was implemented in Ontario schools serving urban, rural and First Nations communities in the 2021-2022, 2022-2023 and 2023-2024 academic years.

3.8 Engagement with schools and school boards

Based on guidance from the Project Steering Committee, the research team applied to several school boards in the Greater Toronto and Hamilton Area. School boards were chosen

based on size of the school board, as larger boards would have more classes available for contact and invitation.

For schools in the urban and rural categories, it was decided that these schools should be non faith-based, public schools. In collaborations with Shkaabe Makwa and the Project Steering Committee, it was decided that research conducted in school boards deemed to be "First Nations" were to be in separate school boards from the participating schools in urban and rural categories. This was to ensure the results were examined separately, and the two categories ("mainstream" i.e., urban/rural; and First Nations) were in different contexts and environments. Additionally, Shkaabe Makwa guided the research team in selecting specific schools within the chosen school boards for the "First Nations" category, which were deemed to be "First Nations".

Ethics applications were submitted to selected school boards on an ongoing basis throughout June 2021 – Oct 2023, after the FASD prevention education curriculum was finalized (First Nations and mainstream turn-key lesson plans). A total of seven school boards granted the study ethics approval, with various restrictions and stipulations outlined in each ethics application approval. Ethics renewal applications were submitted in June 2022 and June 2023.

3.9 Selection of participating schools and classes

Within each participating school board, as many eligible schools as possible (given number of eligible schools and school boards' ethics committee stipulations) were invited to participate. Principals were contacted via email and phone on a rolling basis by the research team.

Schools were selected based on their willingness and capacity to participate in the study. Based on consultation with the principals, it was deemed most suitable for implementation in Physical Health and Education classes, for both intervention and control classes.

In general, when implementing prevention initiatives, it is important to recognize the diversity that exists in student populations and to promote understanding of diverse backgrounds and perspectives. Understanding the influence of family, community and cultural background on the risk of PAE and FASD was central to the decision to analyze data from urban, rural and First Nations schools separately, enrolling schools in different geographic areas. The implementation of the project was guided by the Project Steering Committee and Shkaabe Makwa to ensure culturally appropriate and community-informed approaches. Selected classes were chosen based on the demonstrated interest of the school staff in the project, as well as the suitability of the intervention or control conditions in relation to their current student activities in the class. In some cases, known prevalence of developmental disorders in classes, or ongoing religious holidays (e.g., Ramadan) were factors that affected the decision to participate in the study. Schools demonstrated large variations in their capacity to participate, with some schools having multiple classes participating from different grade levels, and other schools having only one class at one grade level participating. As well, over the course of the three academic years, some schools had both intervention and control classes who participated in the study.

3.10 Data analysis and interpretation

Quantitative data from student pre-test and post-test surveys were examined separately for urban, rural and First Nations schools. Data cleaning was performed using Excel for questions that had multiple "check all that apply" options, in which additional binary variables were created for each response option. Scores were produced for the total number of correct FASD content knowledge items identified (out of 4, pre-test and post-test), total number of incorrect FASD content knowledge items identified (out of 3, pre-test and post-test), total number of units attended by each student (out of 3), and sources of FASD knowledge prior to the survey (out of 7 possible identified sources).

Descriptive statistics were generated from the student surveys to produce group summary measures, pre- and post-implementation, performed using STATA 16. These analyses were stratified by condition (intervention or control) and gender, where applicable. For summary measures from Likert-scale and multiple-choice questions, chi-squared tests were conducted. To examine differences between groups in scores (e.g., total number of correct FASD content knowledge items) in the same stage (pre- and post-test, separately), independent t-tests were conducted. To compare changes in both groups from pre-test to post-test stages, paired t-tests were conducted. Statistical significance for all tests conducted was set at an alpha level of 0.05.

Linear regression models were performed to examine the relationships between the condition (intervention; control) and the final student outcomes at the post-test stage, including total (correct items identified) FASD content knowledge score, increases in the level of importance indicated by students for them to have and support alcohol-free pregnancies, the indicated level of importance of FASD prevention, and the indicated level of importance attributed to having and supporting alcohol-free and drug-free pregnancies later in life.

Qualitative data were synthesized using a thematic analysis in Excel for student and teacher surveys. These data were narratively described for overall findings, with some direct quotations included for the purpose of illuminating future directions for FASD prevention education curriculum adaptation and implementation.

Data on effectiveness and student/teacher feedback are integrated and synthesized for the purpose of stating the overall findings and highlighting future recommendations for both research and school-based FASD prevention initiative implementation.

4.0 RESULTS – URBAN SCHOOLS

4.1 Implementation

A total of 280 students in urban schools participated in the project, including 100 in the control condition and 180 in the intervention. These students were from a total of five different schools and a total of nine classes, with an average of 31 students in each class (range: 20-85). In one instance, three separate middle school classes (total of 85 students in grades 7 and 8) from one school were combined in order to generate a higher response rate to the consent process and better participation overall (Table 1).

4.2 Baseline findings

At baseline, there was a relatively even distribution of gender (46.1% male in intervention; 50.0% male in control), with a small portion of students identifying as other or unknown in each condition. Across the 280 students from urban schools, a greater proportion of students in the intervention (over 76%) were in middle school, while students in the control condition were mostly high school students (78%), p=0.000.

There were no significant differences in between groups on knowledge of alcohol use in general, with the majority of students knowing that alcohol is a toxin (85.8% intervention; 88.8% control) and around half knowing that alcohol is a carcinogen (47.7% intervention; 51.7% control). In terms of baseline knowledge of the risks of alcohol use in pregnancy, there were no significant differences between groups, with 90.8% of students in the intervention group and 88.8% of students in the control group indicating that alcohol is a teratogen. Around three-quarters of students in each group indicated that there is no safe frequency of alcohol consumption during pregnancy (74.1% in both groups) and around three-quarters indicating there is no safe time for a woman to consume alcohol during pregnancy (76.4% intervention; 75.3% control). Lastly, the majority of students in urban schools (83.1% intervention; 82.0% control) had indicated at baseline that the best course of action for a woman who finds out she is pregnant is for her to stop drinking completely.

Table 1. Baseline (pre-test) survey results for students in the intervention and control groups in urban schools (n=280)

Baseline characteristics	Intervention (n=180) Frequency (%)	Control (n=100) Frequency (%)	p-value
Gender – male	83 (46.1)	50 (50.0)	0.094
Grade			
7	57 (32.8)	10 (11.2)	0.000*
8	76 (43.7)	8 (9.0)	
9	16 (9.2)	21 (23.6)	
10	8 (4.6)	20 (22.5)	
11	13 (7.5)	17 (19.1)	
12	4 (2.3)	12 (13.5)	
Knowledge of alcohol use			
Alcohol is a toxin			
Yes	149 (85.6)	79 (88.8)	0.122
Don't know	10 (5.8)	8 (9.0)	
Alcohol is a carcinogen			
Yes	83 (47.7)	46 (51.7)	0.514
Don't know	66 (37.9)	35 (39.3)	
Knowledge of alcohol use in pregnancy			

Baseline characteristics	Intervention (n=180)	Control (n=100)	p-value
	Frequency (%)	Frequency (%)	
Alcohol is a teratogen - yes	150 (90.8)	79 (88.8)	0.466
No safe frequency of alcohol consumption during pregnancy	129 (74.1)	66 (74.1)	0.838
No safe time to consume alcohol during pregnancy	133 (76.4)	67 (75.3)	0.566
A woman should stop drinking completely once she learns she is pregnant	143 (83.1)	73 (82.0)	0.075
Had heard of FASD and/or the negative effects of alcohol use in pregnancy before	94 (49.7)	41 (49.4)	0.799
Sources of prior FASD knowledge**			
Friends	12 (13.6)	2 (9.1)	0.567
Healthcare provider	6 (6.8)	3 (13.6)	0.297
Radio	5 (5.7)	1 (4.6)	0.834
Family	17 (19.3)	5 (22.7)	0.721
Social media / internet	17 (19.5)	5 (22.7)	0.739
Television	19 (21.6)	9 (40.9)	0.063
School	53 (60.2)	6 (27.3)	0.006*
Mean number of sources (SD)	0.7 (1.0)	0.3 (0.7)	0.0002*
FASD content knowledge			
FASD is only seen in babies (incorrect)	24 (13.3)	17 (17.0)	0.406
Individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (correct)	102 (56.7)	35 (35.0)	0.001*
FASD is passed on from mother to child (incorrect)	48 (26.7)	29 (29.0)	0.675
FASD is a disability that lasts a lifetime (correct)	65 (36.1)	25 (25.0)	0.056
FASD only occurs in children whose mothers have alcohol addiction during pregnancy (incorrect)	75 (41.7)	31 (31.0)	0.078
FASD in the child can be prevented if the mother stops drinking during pregnancy (correct)	71 (39.4)	32 (32.0)	0.216

Baseline characteristics	Intervention (n=180)	Control (n=100)	p-value
	Frequency (%)	Frequency (%)	
Exposure to alcohol through breastmilk alone cannot cause FASD (correct)	17 (9.4)	14 (14.0)	0.244
Average number of correct items identified (out of 4) – Mean (SD)	1.42 (0.92)	1.06 (0.12)	0.010*
Average number of incorrect items identified (out of 3) – Mean (SD)	0.82 (0.91)	0.77 (0.95)	0.343

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated
** - denotes statistical significance at the alpha level of 0.05*
*** - denominator includes only students who indicated prior knowledge of FASD*

Students were asked about their previous knowledge of FASD, with just under half (49.7% intervention; 49.4% control) indicating that they had heard of FASD and/or the negative effects of alcohol use in pregnancy before in their lives. Students were also asked about the source/location of their previous learning about FASD. In the survey responses, there were some gaps, wherein students who had indicated they had not heard of FASD before, then indicated several sources of baseline knowledge for FASD. For this reason, percentages in Table 1 are provided for the group overall, instead of for the sub-group who had indicated they had heard of FASD before. Among students in urban schools, prior sources of information/knowledge on FASD includes friends (13.6% intervention; 9.1% control), healthcare providers (6.8% intervention; 13.6% control), radio (5.7% intervention; 4.6% control), family (19.3% intervention; 22.7% control), social media / internet (19.5% intervention; 22.7% control), television (21.6% intervention; 40.9% control) and school (60.2% intervention; 27.3% control). Students in the intervention group were significantly more likely to have heard of FASD in school prior to the survey (p=0.006). When examining the mean number of sources of FASD (out of 7) information, the mean number of sources was significantly higher for the intervention group (mean: 0.72) than for the control group (mean: 0.31) (t=-3.56, df=278, p=0.0002).

When asked about specific aspects of FASD, students were asked to check off all responses that applied in terms of FASD content knowledge. Students in the intervention group (56.7%; compared to 35.0% in control) were more likely to check off the correct answer of "individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability". No other significant differences were observed in the FASD content knowledge response options. Results from two-sample t-test assuming equal variances indicated that there was a significant difference in the average number of correct FASD content knowledge items identified at baseline for intervention students (mean=1.42) compared to control students (mean=1.06), (t= -2.3227, df=278, p=0.010). No significant difference was observed for the average number of incorrect items identified (t= -0.4055, df=278, p=0.3427).

4.3 Curriculum effectiveness (control vs. intervention) in urban schools

Students completed a post-test survey either immediately following the end of the lesson plan (intervention) or three-four days following the pre-test survey (control condition). Table 2 below presents responses from each group based on the items that were the same, including demographics, FASD content knowledge and motivations to have and support alcohol-free pregnancies later in life.

4.3.1 Pre- and post-test differences in surveys

With respect to post-test knowledge of alcohol use, there was an increase in both groups for knowledge that alcohol is a toxin. This increased from 85.6% at baseline to 93.9% at the post-test for students in the intervention group (8.3% increase), and from 88.8% at baseline to 95.2% at the post-test for students in the control group (6.4% increase). A paired t-test was conducted to reveal that this pre-test post-test increase was not significant for the intervention (t=-0.6161, df=179, p=0.2693) or the control group (t=-0.2075, df=99, p=0.4180) (Figure 1).

With respect to knowledge that alcohol is a carcinogen, students in the intervention had a significantly higher proportion indicating it is a carcinogen (82.7% intervention vs. 53.6% in control), p=0.000. Compared to the baseline percentages, there was an increase in both groups for students agreeing it is a carcinogen. This increased from 47.4% at baseline to 82.2% at the post-test for students in the intervention group (34.5% increase), and increased from 51.7% at baseline to 53.6% at the post-test for students in the control group (1.9% increase). A paired t-test was conducted to reveal that this pre-test post-test increase was not significant for the intervention (t=-6.7631, df=179, p=0.0000) group, nor for the control group (t=-0.1732, df=98, p=0.4314).

Both groups demonstrated increases from baseline in identifying alcohol as a teratogen (intervention: to 85.6% to 95.7%; control: 88.8% to 97.6%). However, a paired t-test was conducted to reveal that this pre-test post-test increase was not significant for the intervention (t=0.3325, df=179, p=0.3699) or the control group (t=-0.3763, df=99, p=0.3537).

There was a significantly higher proportion of students in the intervention group who had indicated there was no safe frequency of alcohol consumption during pregnancy (90.8% in intervention vs. 72.6% in control; p=0.003). This is a notable change from baseline, wherein the proportions were similar in each group (74.1% in both; p=0.838). A paired t-test was conducted to reveal that this pre-test post-test increase was significant for the intervention (t=-5.2078, df=179, p=0.0000) but not the control group (t=0.0000, df=99, p=0.5000).

There was also a significantly higher proportion of students in the intervention group indicating there was no safe time to consume alcohol during pregnancy (90.2% in intervention vs. 83.3% in control; p=0.006). Again, this is a notable change from baseline, wherein the proportions were similar in each group (76.4% in intervention vs. 75.3% in control; p=0.566). A paired t-test was conducted to reveal that this pre-test post-test increase was significant for the intervention (t=-4.1833, df=179, p=0.0000) but not the control group (t=-1.6469, df=99, p=0.0514).

Lastly, there was a significantly higher proportion of students in the intervention group (93.3%) compared to the control group at the post-test stage who indicated that the best option for a woman upon learning she is pregnant is to stop drinking alcohol completely (p=0.000). At

baseline, these differences were non-significant (83.1% in intervention vs. 82.0% in control, p=0.075). A paired t-test was conducted to reveal that this pre-test post-test increase was significant for both the intervention (t=-3.5068, df=179, p=0.0003) and the control groups (t=1.7141, df=99, p=0.0448).

With respect to specific components of FASD content knowledge, there were two significant differences between the control and intervention groups in urban schools in answering incorrect items identified at the post-test stage. A higher proportion of students in the control group vs. the intervention group (20.0% vs. 11.1%, respectively) incorrectly indicated that FASD is only seen in babies (p=0.042). Interestingly, at the post-test stage, a higher proportion of students in the intervention group (43.9%) compared to the control group (30.0%) incorrectly indicated that FASD only occurs in children whose mothers have alcohol addiction (p=0.022).

At the post-test stage, there were statistically significant differences in correct FASD content knowledge items identified.

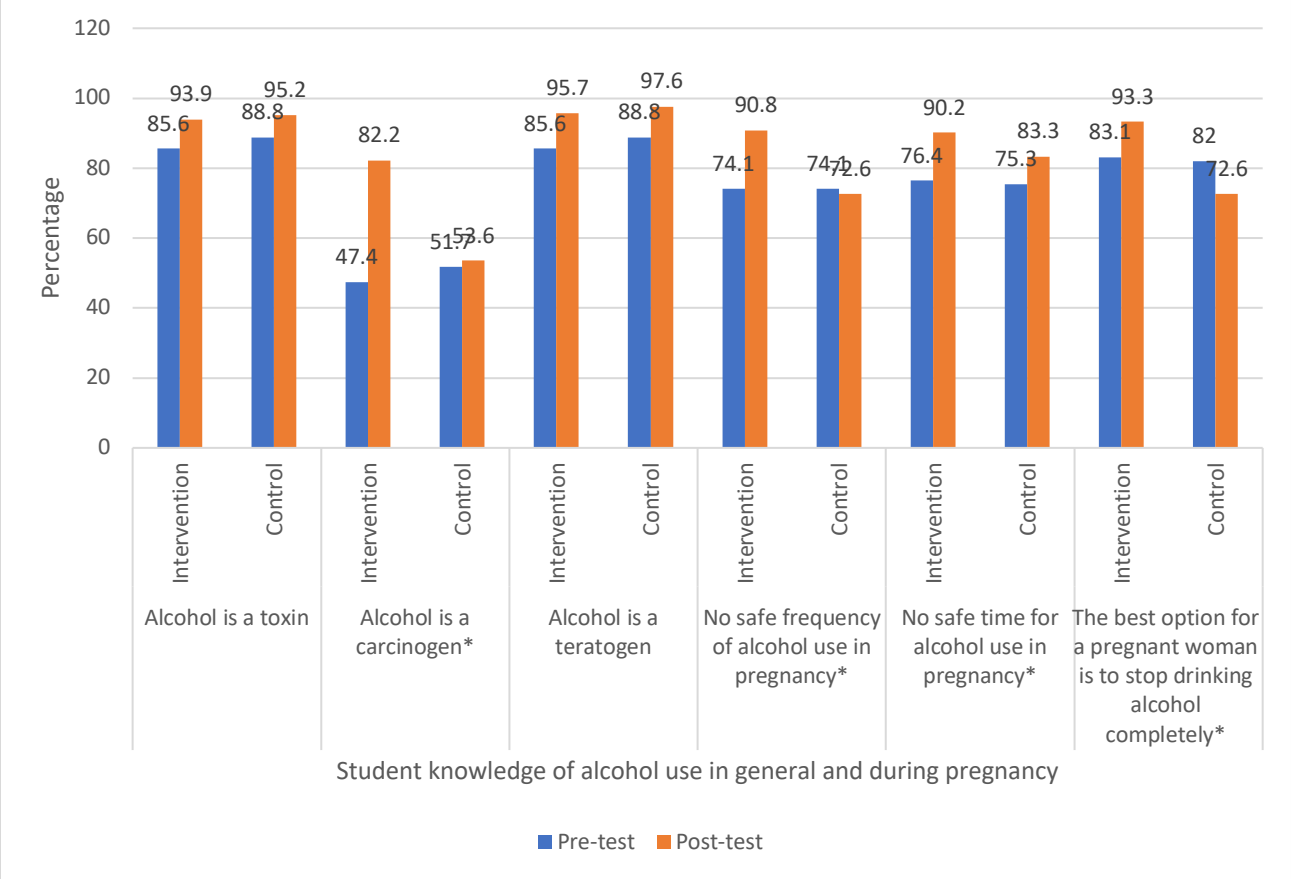

Figure 1. Changes in knowledge of alcohol use in pregnancy among students in the intervention and control groups from urban schools (pre-test and post-test)

A significantly higher proportion of students in the intervention group (72.8%) as compared to the control group (30.0%) correctly indicated that individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (p=0.000). As

well, a significantly higher proportion of students in the intervention group (64.4%) correctly indicated that FASD is a disability that lasts a lifetime (p=0.000). Interestingly, a higher proportion of students in the control group (22.0%) as compared to students in the intervention group (7.8%) correctly indicated that exposure to alcohol through breastmilk alone cannot cause FASD.

Lastly, students in the intervention group had a significantly higher average number of correct items identified (total score) at the post-test (mean=1.94), compared to students in the control group (mean=1.19), p=0.000, consistent with the "Correct Items Only" findings shown in Figure 1.

Notably, both post-test means were higher than the corresponding pre-test means (1.42 for the intervention group and 1.06 for the control group), indicating improvements over time in both groups. A paired t-test revealed that the increase in the number of correct FASD content knowledge items from the pre-test to post-test stages was statistically significant for students in the intervention group (t=-4.9618, df=179, p=0.0000), but not for students in the control group (t=-0.8656, df=99, p=0.1944) (Figure 2).

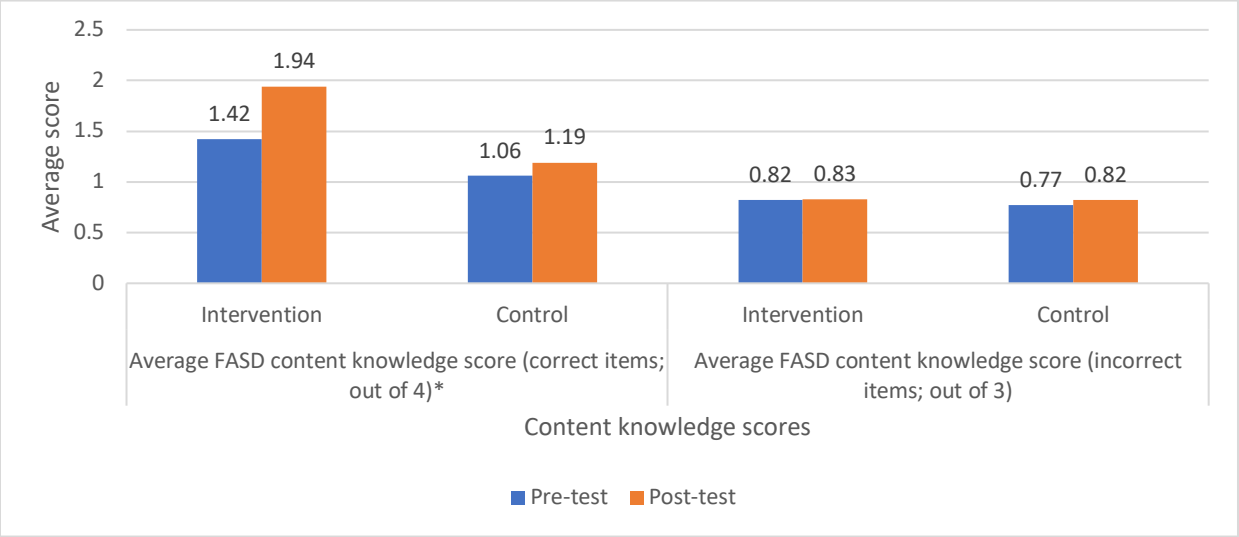

Figure 2. Changes in FASD content knowledge scores among students in the intervention and control groups from urban schools (pre-test and post-test)

The average number of incorrect FASD knowledge responses (out of 3) changed only slightly from pre-test to post-test for the intervention (0.82 to 0.83) and the control group (0.77 to 0.82), respectively. A paired t-test indicated that these changes were not statistically significant in either group: intervention (t=-0.1539, df=179, p=0.4389) or control (t=-0.4286, df=99, p=0.3346).

Table 2 also indicates personal motivations and views on FASD prevention and alcohol-free pregnancies. These questions were not asked at the pre-test stage for either of the groups, as the team prioritized getting baseline information on FASD knowledge at the pre-test.

A significant difference between the intervention and control groups was observed at the post-test stage with respect to their view that it is personally important to them to understand

how to have and support alcohol-free and drug free pregnancies. Interestingly, it seems that a greater proportion of students in the control group (53.6%) said that it was extremely important to them versus 38.7% of students in the intervention group (p=0.018).

Table 2. Post-test survey responses among students in urban schools

Characteristics	Intervention (n=180) Frequency (%)	Control (n=100) Frequency (%)	p-value
Gender – male	83 (46.1)	50 (50.0)	0.094
Grade			
7	57 (32.8)	10 (11.2)	0.000*
8	76 (43.7)	8 (9.0)	
9	16 (9.2)	21 (23.6)	
10	8 (4.6)	20 (22.5)	
11	13 (7.5)	17 (19.1)	
12	4 (2.3)	12 (13.5)	
Knowledge of alcohol use			
Alcohol is a toxin			
Yes	153 (93.9)	80 (95.2)	0.893
Don't know	7 (4.3)	3 (3.6)	
Alcohol is a carcinogen			
Yes	134 (82.2)	45 (53.6)	0.000*
Don't know	25 (15.34)	29 (34.5)	
Knowledge of alcohol use in pregnancy			
Alcohol is a teratogen - yes	156 (95.7)	81 (97.6)	0.342
No safe frequency of alcohol consumption during pregnancy	148 (90.8)	61 (72.6)	0.003*
No safe time to consume alcohol during pregnancy	147 (90.2)	70 (83.3)	0.006*
A woman should stop drinking completely once she learns she is pregnant	152 (93.3)	61 (72.6)	0.000*
FASD content knowledge			
FASD is only seen in babies (incorrect)	20 (11.1)	20 (20.0)	0.042*
Individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (correct)	131 (72.8)	30 (30.0)	0.000*
FASD is passed on from mother to child (incorrect)	50 (27.8)	32 (32.0)	0.457

Characteristics	Intervention (n=180) Frequency (%)	Control (n=100) Frequency (%)	p-value
FASD is a disability that lasts a lifetime (correct)	116 (64.4)	30 (30.0)	0.000*
FASD only occurs in children whose mothers have alcohol addiction during pregnancy (incorrect)	79 (43.9)	30 (30.0)	0.022*
FASD in the child can be prevented if the mother stops drinking during pregnancy (correct)	88 (48.9)	37 (37.0)	0.055
Exposure to alcohol through breastmilk alone cannot cause FASD (correct)	14 (7.8)	22 (22.0)	0.001*
Average number of correct items identified (out of 4) – Mean (SD)	1.94 (1.24)	1.19 (1.30)	0.000*
Average number of incorrect items identified (out of 3) – Mean (SD)	0.83 (0.85)	0.82 (0.98)	0.472
Personally important to them to understand how to have and support alcohol-free and drug-free pregnancies			
Not at all important	1 (0.6)	4 (4.8)	0.018*
Only slightly important	18 (11.0)	7 (8.3)	
Important	76 (46.6)	28 (33.3)	
Extremely important	63 (38.7)	45 (53.6)	
FASD prevention is personally important to them			
Not at all important	5 (3.1)	9 (10.7)	0.025*
Only slightly important	22 (13.5)	16 (19.0)	
Important	68 (41.7)	28 (33.3)	
Extremely important	67 (41.1)	26 (30.9)	
Personally important to them to abstain from alcohol and other drugs during pregnancy later in life *(females only – not applicable for male students)*			
Not at all important	4 (2.4)	0 (0.0)	0.076
Only slightly important	2 (1.2)	0 (0.0)	
Important	24 (14.7)	5 (5.9)	
Extremely important	52 (31.9)	31 (36.9)	
Not applicable	79 (48.5)	48 (57.1)	
Personally important to them to support others in having alcohol-free and drug-free pregnancies later in life (males only)			
Not at all important	1 (0.6)	5 (6.0)	0.114
Only slightly important	7 (4.3)	4 (4.8)	
Important	35 (21.5)	20 (23.8)	
Extremely important	35 (21.5)	17 (20.2)	
Not applicable	83 (50.9)	38 (45.2)	

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated
** - denotes statistical significance at the alpha level of 0.05*

A significant difference was also observed with respect to the view that FASD prevention is personally important to students, with 41.7% and 41.1% of students in the intervention group indicating it was important or extremely important (respectively), and 33.3% and 30.9% of students in the control group indicating it was important or extremely important to them (respectively), p=0.025.

No significant differences were observed between the control and intervention groups with respect to the last two post-test survey items, asking female and male students, respectively, if it will be personally important to them to either abstain from alcohol and other drugs during pregnancy or to support others in having alcohol-free and drug-free pregnancies later in life.

4.3.2 Linear regression analyses for urban schools

To examine the relationship between the assigned condition (intervention or control) and several student outcomes, including FASD content knowledge and motivations related to FASD prevention, linear regression models were conducted (Table 3). Based on the descriptive statistics reflecting group differences and inconsistencies in implementation, covariates were chosen for these models, including gender, grade, previous knowledge of FASD (yes/no at baseline), and the total number of units attended (0-3 for intervention; 0 for control). A positive relationship was found, with the condition (intervention) significantly predicting a higher score on the total number of correct FASD content knowledge at the post-test stage, $F(5,255)=20.03$, $R^2=0.28$, $p=0.000$.

Table 3. Parameters of linear regression models examining the relationship between study condition (intervention) and outcome variables at the post-test stage in urban schools

Student outcome variable	R^2, F-test value	p-value
Correct FASD content knowledge identified (score)	$R^2 = 0.28$, $F(5,255) = 20.03$	0.000*
Level of importance of having and supporting alcohol-free pregnancies	$R^2 = 0.07$, $F(5,221) = 3.67$	0.003*
Level of importance of FASD prevention	$R^2 = 0.12$, $F(5,221) = 6.13$	0.000*
Level of importance of abstaining from alcohol and other drugs during pregnancy	$R^2 = 0.11$, $F(5,108) = 2.84$	0.018*
Level of importance of	$R^2 = 0.02$,	0.657

Student outcome variable	R^2, F-test value	p-value
supporting others in having alcohol-free and drug-free pregnancies later in life	F(5,108) = 0.66	

Note: linear regression models have been adjusted for gender, grade, previous knowledge of FASD, and the total number of units attended
** - denotes statistical significance at the alpha level of 0.05*

Using the same covariates, we examined additional outcome variables related to student motivation for FASD prevention in relation to the intervention condition.

This adjusted model significantly predicted increases in the level of importance indicated by students for them to have and support alcohol-free and drug-free pregnancies (p=0.003). As well, the adjusted model was positively associated with the indicated level of importance of FASD prevention (p=0.000), meaning that the lesson plan is associated with higher levels of student-attributed importance of FASD prevention. Lastly, the adjusted linear model is significantly associated with higher levels of importance among female students attributed to having alcohol-free and drug-free pregnancies later in life (p=0.018).

4.4 Students' perceptions of the curriculum in urban schools (intervention only)

Of note, there were several free-form notes by students on the paper surveys beside these specific questions about motivations to have and support alcohol-free and drug-free pregnancies later in life. Several students indicated that they do not drink for religious reasons, and therefore these questions are not applicable to them or their culture. Two students from urban schools explicitly stated that they had no intentions of having pregnancies later in life or to have their own children, which impacted their responses.

Several post-test survey items pertained only to the intervention survey design, related to attendance, their views on the FASD prevention education curriculum content, their perceptions of their own learning, and any suggestions they have for improving the curriculum. These items were examined by gender responses at the pre-test stage for consistency (Table 4).

Table 4. Perceptions of the FASD prevention education curriculum among students in the intervention condition in urban schools (n=161)

Baseline characteristics	Intervention (n=161)			p-value
	Female (n= 86)	Male (n=94)	Total (n=180)	
Present for all 3 units in class	59 (68.6)	63 (67.0)	122 (67.8)	0.753
Units that were more helpful to your learning (check all that apply)				
Unit 1: Impacts of alcohol use on teen health	48 (55.8)	55 (58.5)	103 (57.2)	0.715
Unit 2: Impacts of alcohol use in pregnancy and Fetal	52 (60.4)	54 (57.4)	106 (58.9)	0.681

Baseline characteristics	Intervention (n=161)			p-value
	Female (n= 86)	Male (n=94)	Total (n=180)	
Alcohol Spectrum Disorder (FASD)				
Unit 3: Supporting alcohol-free and drug-free pregnancies	22 (25.9)	35 (37.2)	57 (31.7)	0.093
None	0 (0.0)	0 (0.0)	0 (0.0)	n/a
How do you feel that your understanding of alcohol use and FASD has changed after the lesson?				
Significantly improved	20 (26.3)	34 (39.5)	54 (33.3)	0.238
Moderately improved	34 (44.7)	25 (29.1)	59 (36.4)	
Slightly improved	15 (19.7)	21 (24.4)	36 (22.2)	
No change	5 (6.6)	4 (4.7)	9 (5.6)	
A lesser understanding than before	2 (2.6)	2 (2.3)	4 (2.5)	
Do you feel you learned useful information in this class that will be helpful to you later in life (i.e., adulthood)?				
Yes	65 (95.6)	66 (93.0)	131 (94.2)	0.581
No	3 (4.4)	4 (5.6)	7 (5.0)	
Can't tell	0 (0.0)	1 (1.4)	1 (0.7)	
Unit 3 prepared me well to have and support alcohol-free pregnancies				
Yes	45 (75.0)	43 (58.1)	92 (71.3)	0.683
No	3 (5.0)	3 (4.1)	7 (5.4)	
Somewhat	12 (20.0)	18 (26.1)	30 (23.3)	
I am likely to use these strategies to abstain from alcohol in youth and support alcohol-free pregnancies now and later in life				
Yes	56 (87.5)	45 (58.4)	101 (71.6)	0.001*
No	1 (1.5)	7 (9.1)	8 (5.7)	
Somewhat	7 (10.9)	25 (32.5)	32 (22.7)	

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated
** - denotes statistical significance at the alpha level of 0.05*

Roughly two-thirds of students in the intervention group in urban schools (68.6% of females and 67% of males), were present for all three units in class, with no significant differences based on gender. Over half of students (55.8% of females and 58.5% of males) in the intervention group found Unit 1 to be helpful to their learning, which focused on the impacts of alcohol use on teen health. Over half of students (60.4% of females and 57.4% of males) found Unit 2 to be helpful to their learning, which focused on the impacts of alcohol use in pregnancy and FASD. Lastly, there were smaller proportions observed (25.9% of females and 37.2% of males) for students indicating that Unit 3 was helpful to their learning, which focused on strategies to support alcohol-free and drug-free pregnancies later in life. No significant

differences were found with respect to male and female students in their perceptions of the units being helpful to their learning.

The majority of students felt that their understanding of alcohol use and FASD had significantly improved (26.3% of females; 39.5% of males) or moderately improved (44.7% of females; 29.1% of males) after the lesson. Only a small fraction indicated no change (6.6% of females; 4.7% of males) or a lesser understanding than before (2.6% of females and 2.3% of males). An overwhelming majority of students (95.6% of females; 93.0% of males) indicated that they felt they learned useful information in this class that will be helpful to them later in life (i.e., in adulthood). Lastly, the majority of students indicated they were likely to abstain from alcohol in youth and support alcohol-free pregnancies now and later in life; however, this was significantly higher in female students (87.5%) versus male students (58.4%), p=0.001.

4.4.2 Written feedback from students in the intervention condition from urban schools

Four main themes were identified in the responses from students in urban schools who gave feedback on the lesson plan and suggestions for how to improve.

1. **No suggestions identified; okay or good as is**
    - "Nope I do not have any suggestions for how it can be improved"
    - "I don't think it needs improvement"
    - "I don't think that I have any suggestions for how it can be improved"
    - "The presentation was good and it didn't need any improve"
    - "I think it was good."
    - "Nothing can be improved. I feel like I learned enough information to understand the effects of alcohol drinking during pregnancy. "
    - "No, it was very informative"
    - "Nope it was informative and fun to learn about :) "

2. **To make the presentation more visually appealing and/or engaging**
    - "Maybe have the video little larger, but I thought the video was very helpful and I got to learn more about teens and alcohol."
    - "I'd say going through each point individually on a slide rather than a wall of information on one slide will probably keep things simple, rather than overwhelming students with a lot of words."
    - "I feel more videos could help with those who visually learn"
    - "Maybe there could be some physical diagrams which would give students a better understanding of how FASD spreads"
    - "easier descriptions to show real examples and make it more interesting"
    - "The only suggestion I have is to make it slightly more entertaining, even if it's a serious topic such as this. "
    - Also this video that we watched kept repeating herself, like gurl we goddamn get that we shouldn't drink while we're pregnant. "
    - "more videos please"

3. **<u>To cut down on the length of the presentation</u>**
    - "I personally think that it was really good. I found it very informative but one thing I would try to improve would be grabbing people's attention. I have a very hard time focusing so sometimes I struggled to pay attention."
    - "Make it shorter, it's boring as hell, make kahoot"
    - "I think that the units should be shorter. Not everything needs to be said. I feel like most people already knew stuff."
    - "It repeats a lot of information. It felt like it was the same. Also, I felt that it was a bit long for middle school."
    - "It was too long and not a lot of information"
    - "I think they should make less slides since too much, takes the interest out."
    - "make each unit shorter so there is more time to discuss FASD rather than alcohol in general as we learned that already"
    - "I think to improve this presentation you should include the audience into it a bit more. Also it was a little long."
    - "A little long. The explanations were too long and can be shortened."
    - "This can be improved by the presentation being shorter. I feel like the presentation could use better videos and more visuals."
    - "It would be better if it's short because I keep on being bored and not focused. To help with this you can have a person come in with items to demonstrate."
    - "Some parts of the presentation were very long and repetitive so making it less repetitive"
    - "I think that we can improve on combining the information as the presentation is a bit lengthy for students with low attention span."

4. **<u>Make the curriculum more widespread and/or increase FASD awareness in general</u>**
    - "just try to stop kids from doing it"
    - "being told about it throughout life"
    - "have every health class do this program"
    - "FASD should be more known to the general public"
    - "Making kids do it again to see what they remember or ask them what they would do in a situation and see what they say or raise the limits for alcohol so these kids can be safer or show the parents the danger so the parents could make sure the kids are healthy"
    - "widening the educational research to not just schools, but the general public. When you hit a certain age, you should be required to take a sort of FASD test so everyone knows the dangers"
    - "it can be improved by promoting boycott and law especially strict against use of alcohol"
    - "Females over the age of 18 years must take a test to see if they are pregnant or not so they can know whether to drink or not."
    - "you should try cutting back on alcohol and if she has a baby that has FASD try raising it like a normal baby and do not get an abortion"

- “I think it could be improved by talking about how to help someone's mental health so people don't turn to drugs and alcohol”
- “Yes I do have a suggestion for how to improve the worldwide knowledge of this topic. I didn't know much about FASD before these units and I am in grade 12. All younger grades need to be taught this once a year. This way, it will get more people to prevent it.”
- “No not really I just think everyone should be aware.”
- “Focus not only on women, but men too. What should be their role and so on.”
- “Maybe give more alternatives to drinking. Also better alternatives. Add more information on men.”
- “Also if they will be doing this presentation in the future, they might as well make it for the whole school. So that everyone can hear and know about it.”
- “this information should be more widespread”
- “expand more information to a wide range of people”
- “learn in high school instead of middle school”.

4.5 Teachers’ perceptions of the mainstream FASD prevention education curriculum in the intervention condition in urban schools

A total of five teachers from the classes in urban schools who participated in the intervention, completed the teacher survey. Responses indicated a range of number of years of teaching experience (7-25 years), and were filled out by both middle school and secondary teachers. The majority of teachers indicated that they were personally present for all three units of the lesson plan. All participating teachers indicated that Unit 2 was helpful to their students, while there were varying responses for if Units 1 and 3 were helpful. All teachers indicated that the lesson plan helped at least somewhat to improve their own general knowledge of alcohol use in pregnancy and FASD. All teachers indicated that the Teacher Guide document helped them feel prepared to facilitate the discussions required in the lesson plan.

The written feedback from teachers overwhelmingly included suggestions to shorten the lesson plan, particularly for middle school students, and to make it more visually appealing and engaging. Teachers suggested to condense the lesson plan into chunks such that it could be more interactive, with some suggesting that more student discussions and interactive activities could increase student learning from the lesson plan itself. The majority of teachers recommended this lesson plan to be included in the Ontario Health curriculum for both middle school and high school grades, upon modification as suggested by them.

4.6 Main findings for students in urban schools (n=280)

Analyses examining pre-test and post-test surveys demonstrated that the FASD prevention education curriculum is effective in the following educational aspects for students in urban schools:

- Teaching students that alcohol is a carcinogen

- Teaching students there is no safe frequency of alcohol consumption during pregnancy
- Teaching students there is no safe time to consume alcohol during pregnancy
- Increasing student knowledge of FASD (e.g., that FASD is a lifelong disability)

Based on post-test surveys only (not asked at baseline), we can see that the intervention is associated with:

- Higher proportions of students indicating that it is personally important to them to understand how to have and support alcohol-free pregnancies
- Higher proportions of students indicating that FASD prevention is personally important to them.

Linear regression analyses found that when adjusted for gender, grade, previous knowledge of FASD (prior to the study) and the total number of curriculum units attended, the intervention is associated with the following at the post-test stage:

- A higher total FASD content knowledge score;
- A higher level of student-indicated importance of having and supporting alcohol-free pregnancies;
- A higher level of student-indicated (personal) importance of FASD prevention; and
- A higher level of student-indicated (personal) importance of abstaining from alcohol and other drugs during pregnancy.

A great deal of positive feedback was received on the FASD prevention education curriculum used in the intervention, from students and teachers. These qualitative data (un-quantified) revealed that many students believed the curriculum did not need improvement, and that the curriculum needs to be more widespread, with more large-scale efforts to increase FASD awareness in general, both during and after school. In fact, the majority of teachers surveyed recommended this lesson plan to be included in the Ontario Health curriculum for both middle school and high school grades, upon modification as suggested by them.

Feedback from students and teachers also revealed opportunities to improve the curriculum used in the intervention, including to shorten the length of the presentation and to make it more visually appealing, engaging and/or interactive.

5.0 RESULTS – RURAL SCHOOLS

5.1 Implementation

A total of 66 students in rural schools participated in the project, all of which participated in the control condition only. These were from two schools, with four classes participating in total, including two split classes from a secondary school.

5.2 Pre-test and post-test survey findings for students from the control group in rural schools

There was a range of students in each grade level from 7-12 (range: 12.5% - 26.6%), with the largest portion of students being from grades 9 (25.0%) and 11 (26.6%), with less than half of students being male (45.4%) (Table 5).

The majority of students (82.8%) indicated at baseline that alcohol is a toxin, which decreased slightly to 82.1% at the post-test stage, which was a significant difference based on a paired t-test (t=1.98, df=65, p=0.028). At the pre-test stage, over half (56.2%) of students in the control group indicated that alcohol is a carcinogen, which decreased to 46.4% at the post-test stage, and was also found to be significant (t= 2.0056, df=65, p=0.0245) (Figure 3).

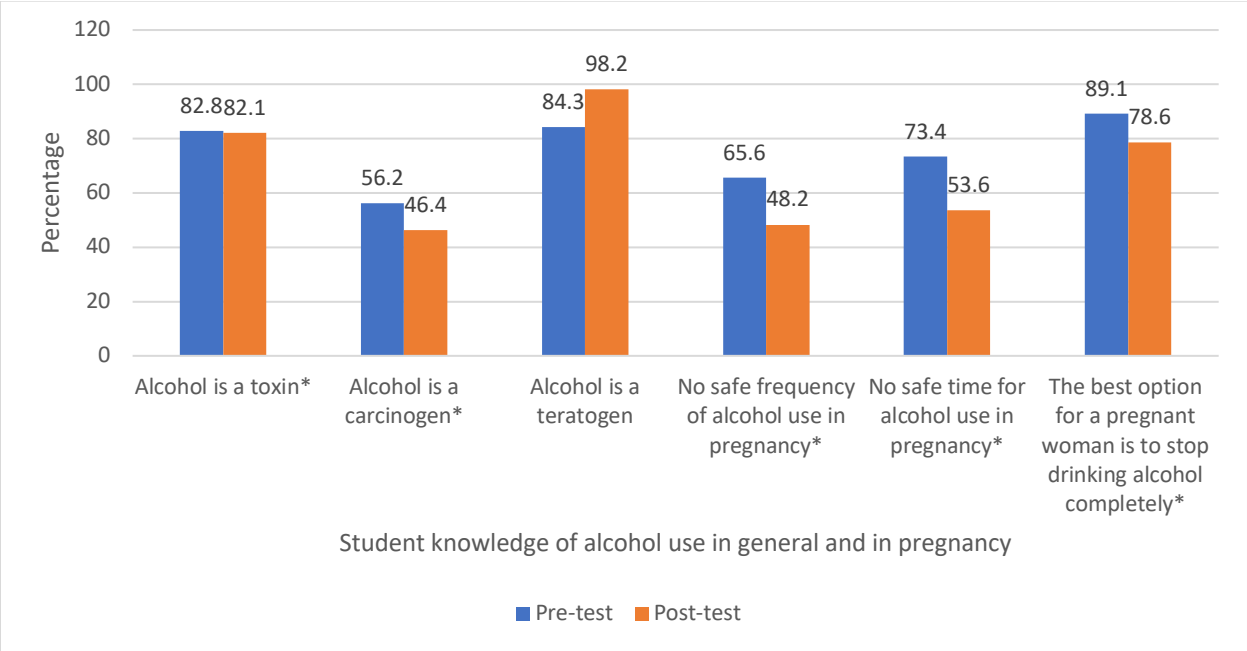

Figure 3. Changes in knowledge of alcohol use in pregnancy among students from rural schools in the control group (pre-test and post-test)

Knowledge of alcohol use in pregnancy was quite high in this group overall at baseline: with 84.3% of students indicating that alcohol is a teratogen, 65.6% of students indicating that there is no safe frequency of alcohol consumption during pregnancy; 73.4% indicating there is no safe time to consume alcohol during pregnancy and 89.1% indicating a woman should stop drinking alcohol completely upon learning that she is pregnant. At the post-test stage, among these students in the control group, knowledge of alcohol being a teratogen increased to 98.2%, whereas the other components had smaller proportions of students indicating agreement at the post-test stage compared to baseline (48.2%; 53.6%; and 78.6%; respectively). Conducted paired t-tests revealed that the pre-test to post-test change in these items was the following for students in rural schools: non-significant for knowledge that alcohol is a teratogen (t=-0.2278, df=65, p=0.4103); significant for knowledge that there is no safe frequency of alcohol consumption during pregnancy (t=10.3543, df=65, p=0.0000); significant for knowledge that there is no safe

time to consume alcohol during pregnancy (t=8.6399, df=65, p=0.000); and significant for knowledge that a woman should stop drinking alcohol completely once she learns she is pregnancy (t=25.4951, df=65, p=0.0000).

A total of 29 (45.3%) of students indicated they had heard of FASD and/or the negative effects of alcohol use in pregnancy before (prior to the survey). Among these students, the most common FASD information sources included school (48.2%), family (44.8%), television (37.9%) and friends (37.9%). Across all students in the rural category (n=66), there was an average number of 0.9 (SD: 1.4) FASD information sources indicated.

Table 5. Pre-test and post-test survey results for students from the control group in rural schools (n=66)

Characteristics	Pre-test Frequency (%)	Post-test Frequency (%)	p-value
Gender – male	30 (45.4)	30 (45.4)	n/a
Grade			
7	8 (12.5)	8 (12.5)	n/a
8	8 (12.5)	8 (12.5)	
9	16 (25.0)	16 (25.0)	
10	8 (12.5)	8 (12.5)	
11	17 (26.6)	17 (26.6)	
12	7 (10.9)	7 (10.9)	
Knowledge of alcohol use in general			
Alcohol is a toxin			
Yes	52 (82.8)	46 (82.1)	0.026*
Don't know	10 (15.6)	9 (16.1)	
Alcohol is a carcinogen			
Yes	36 (56.2)	26 (46.4)	0.025*
Don't know	17 (26.6)	18 (32.1)	
Knowledge of alcohol use in pregnancy			
Alcohol is a teratogen - yes	54 (84.3)	55 (98.2)	0.410
No safe frequency of alcohol consumption during pregnancy	42 (65.6)	27 (48.2)	0.000*
No safe time to consume alcohol during pregnancy	47 (73.4)	30 (53.6)	0.000*
A woman should stop drinking completely once she learns she is pregnant	57 (89.1)	44 (78.6)	0.000*
Had heard of FASD and/or the negative effects of alcohol use in pregnancy before	29 (45.3)	n/a	n/a
Sources of prior FASD knowledge*			

Characteristics	Pre-test	Post-test	p-value
	Frequency (%)	Frequency (%)	
Friends	11 (37.9%)	n/a	n/a
Healthcare provider(s)	5 (17.4%)	n/a	
Radio	0 (0.0)	n/a	
Family	13 (44.8)	n/a	
Social media / internet	6 (20.7)	n/a	
Television	11 (37.9)	n/a	
School	14 (48.2)	n/a	
Mean number of sources (SD)	0.9 (1.4)	n/a	
FASD content knowledge			
FASD is only seen in babies (incorrect)	10 (15.2)	12 (18.2)	0.283
Individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (correct)	41 (62.1)	17 (25.8)	0.000*
FASD is passed on from mother to child (incorrect)	22 (33.3)	25 (37.9)	0.283
FASD is a disability that lasts a lifetime (correct)	34 (51.5)	14 (21.2)	0.000*
FASD only occurs in children whose mothers have alcohol addiction during pregnancy (incorrect)	28 (42.4)	18 (27.3)	0.033*
FASD in the child can be prevented if the mother stops drinking during pregnancy (correct)	23 (34.8)	29 (43.9)	0.138
Exposure to alcohol through breastmilk alone cannot cause FASD (correct)	9 (13.6)	13 (19.7)	0.188
Average number of correct items identified (out of 4) – Mean (SD)	1.62 (0.16)	1.10 (0.99)	0.003*
Average number of incorrect items identified (out of 3) – Mean (SD)	0.91 (0.99)	0.83 (1.07)	0.316

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated

** - denotes statistical significance at the alpha level of 0.05*

*** - denominator includes only students who indicated prior knowledge of FASD*

FASD content knowledge was measured at both survey stages among students in rural schools (control group only). At the pre-test stage, the majority of students (62.1%) correctly identified that individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability, and this proportion significantly decreased to 25.8% at the post-test stage (t=5.1640, df=65, p=0.000). Similarly, over half (51.5%) of students correctly indicated that FASD is a disability that lasts a lifetime at the pre-test stage, and this significantly decreased to 21.2% at the post-test stage (t= 4.2374, df=65, p=0.000). There were, however, increases in proportions indicating correct FASD content items identified from the pre-test stage to the post-test stage, including an increase from 34.8% to 43.9% in the proportion indicating that FASD in the child can be prevented if the mother stops drinking during pregnancy (non-significant), and an increase from 13.6% to 19.7% indicating that exposure to alcohol through breastmilk alone cannot cause FASD (non-significant).

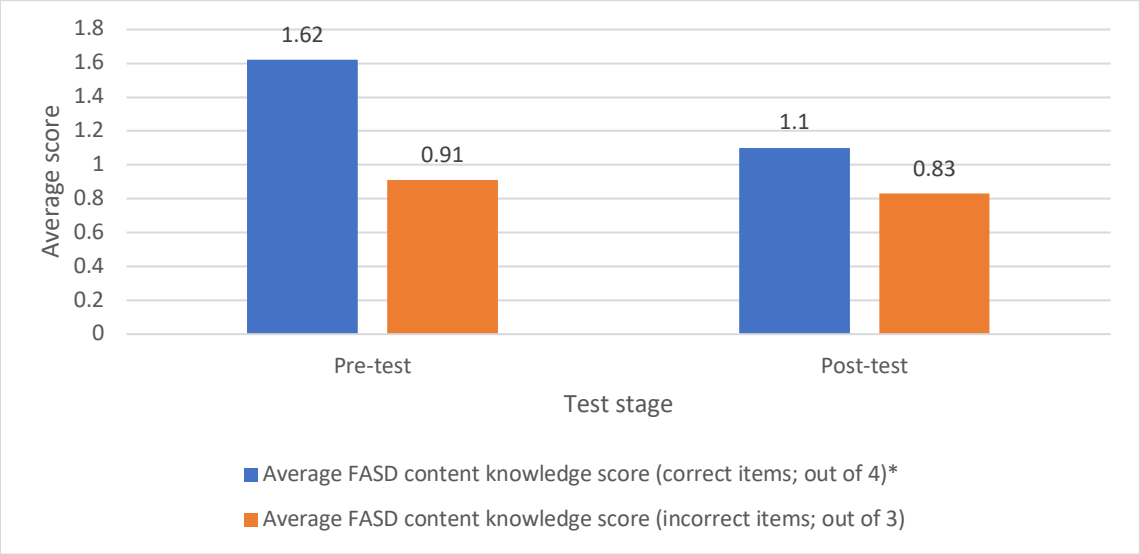

Figure 4. Changes in FASD content knowledge scores among students from rural schools in the control group (pre-test and post-test)

With respect to incorrect FASD content knowledge items identified, a minor increase was observed in the proportion of students in the control group incorrectly indicating that FASD is only seen in babies (15.2% pre-test to 18.2% post-test; non-significant). An increase was also observed for the proportion of students incorrectly indicating that FASD is passed on from mother to child (33.3% pre-test to 37.9% post-test; non-significant). In contrast, there was a significant decrease observed in the third incorrect FASD content knowledge item, from 42.4% of students indicating FASD only occurs in children whose mothers have alcohol addiction during pregnancy at the pre-test stage, to 27.3% of students indicating this in the post-test stage (t=1.8594, df=65, p=0.0337).

Lastly, the average number of correct items identified decreased with testing, from an average of 1.62 out of 4 at pre-test to an average of 1.10 at the post-test stage. There was a slight decrease in the average number of incorrect items identified as well, with an average of 0.91 incorrect items identified at baseline to 0.83 incorrect items identified at the post-test stage. A

paired t-test revealed that the total number of correct FASD content knowledge items identified from the pre-test to post-test stages decreased significantly for students in rural schools (t=2.8267, df=65, p=0.0031) (Figure 4). A separate paired t-test revealed that the total incorrect FASD content knowledge score did not significantly change from the pre-test to the post-test stage (t=0.4805, df=65, p=0.3162).

5.3 Post-test findings for students in the control group in rural schools

Several survey items were specific to the post-test survey and are included below in a separate table (Table 6). These items have been stratified by the gender indicated at the pre-test stage, for consistency.

At the post-test stage, the majority of students in the control group indicated that it is personally important for them to understand how to have and support alcohol-free pregnancies, with 44.8% of females and 18.5% of males indicating it is important, and 42.3% of females and 74.1% of males indicating it is extremely important to them. No significant differences were found with respect to gender. Similarly, the majority of students indicated that FASD prevention is personally important to them, with 40.7% of females and 50.0% of males indicating it is important, and 37.0% and 23.1% of females and males, respectively, indicating it is extremely important to them.

When asked if it will be personally important to students to abstain from alcohol and other drugs during pregnancy (females only) or whether it will be personally important to them to support alcohol-free and drug-free pregnancies later in life (males only), these survey items generated quite low response rates (20 and 34 students out of 66, respectively). As well, it is evident that both male and female students answered both of these gender-specific questions. However, the majority of responding students indicated that these items were important or extremely important to them, with no significant differences found with respect to gender.

Table 6. Post-test survey responses among students in rural schools in the control group, by gender

Survey responses	Female (n=29)	Male (n=27)	Total (n=56)	p-value
	Frequency (%)	Frequency (%)	Frequency (%)	
Personally important to them to understand how to have and support alcohol-free and drug-free pregnancies				
Not at all important	1 (3.5)	1 (3.7)	3 (3.6)	0.208
Only slightly important	1 (3.5)	1 (3.7)	2 (3.6)	
Important	13 (44.8)	5 (18.5)	18 (32.1)	
Extremely important	14 (42.3)	20 (74.1)	34 (60.7)	
FASD prevention is personally important to them				
Not at all important	3 (11.1)	2 (7.7)	5 (9.4)	

Survey responses	Female (n=29)	Male (n=27)	Total (n=56)	p-value
	Frequency (%)	Frequency (%)	Frequency (%)	
Only slightly important	3 (11.1)	5 (19.2)	8 (15.1)	0.604
Important	11 (40.7)	13 (50.0)	24 (45.3)	
Extremely important	10 (37.0)	6 (23.1)	16 (30.2)	
Personally important to them to abstain from alcohol and other drugs during pregnancy later in life (females only)				
Important	2 (12.5)	1 (25.0)	3 (15.0)	
Extremely important	14 (87.5)	3 (75.0)	17 (85.0)	
Personally important to them to support others in having alcohol-free and drug-free pregnancies later in life (males only)				
Not at all important	0 (0.0)	2 (8.7)	2 (5.9)	0.205
Only slightly important	1 (9.1)	1 (4.3)	2 (5.9)	
Important	6 (63.6)	7 (30.4)	14 (41.2)	
Extremely important	3 (27.3)	13 (56.5)	16 (47.1)	

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated

5.4 Main findings for students in the control group from rural schools (n=66)

The research team was unable to implement the intervention condition in schools serving students from rural communities. Though this is a limitation, it also presented a unique opportunity to study the sole effect of testing on FASD content knowledge, and the motivations of students related to FASD prevention who have not been part of the intervention.

Based on the pre-test and post-test findings in the control group, we can conclude that testing alone may have a practice effect and change students' responses over time. Testing seems to increase the proportions of students indicating a belief that there is no safe time or frequency of alcohol consumption during pregnancy and that the safest choice is for a woman to stop drinking completely once she learns she is pregnant.

Interestingly, testing decreased the overall FASD content knowledge scores for both incorrect and correct items identified in the control group. This may indicate confusion from students and/or a lack of willingness to check off all items on this survey question (check all that apply question).

The self-identified importance of having and supporting alcohol-free pregnancies later in life was high (89%-100%), as well as being able to personally understand how to do this (92.8%) and the self-identified importance of FASD prevention in general (75.5%). There were no significant differences with respect to student gender on motivations to have and support-alcohol free pregnancies, or the self-identified importance of FASD prevention in general.

6.0 RESULTS – FIRST NATIONS SCHOOLS

6.1 Implementation

A total of 298 students in schools serving First Nations communities participated in the project, of which 92 participated in the control condition and 206 participated in the intervention. These schools were all off-reserve and the main language of instruction was English. This included a total of 8 classes across five schools deemed to be serving First Nations students. Upon consultation with principals, it was indicated that between 30-40% of students in these schools identified as First Nations. Data on specific First Nations or Indigenous identity was not collected as part of the student surveys.

6.2 Baseline Findings

Baseline data were collected at the pre-test stage for students in First Nations schools (Table 7). Both intervention and control groups had a larger proportion of female students, with 47.5% and 41.3% identifying as male, respectively. While there was no significant difference between intervention and control groups with respect to gender, there was a significant difference in the distribution of grade levels, with the majority of students being from middle schools (9.9% grade 7 and 66.1% grade 8 for intervention; 65.9% grade 7 and 20.5% grade 8 for control), p=0.000. This was largely due to the small class sizes of secondary classes willing to participate in the study.

With respect to knowledge of alcohol use in general, the majority of students (81.5% intervention; 81.9% control) indicated that alcohol is a toxin in both groups (non-significant). This is in comparison to knowledge that alcohol is a carcinogen (40.2% intervention; 34.9% control), in which there is a significant difference between groups, with a higher proportion of students in the intervention category at baseline indicating “don’t know”.

There was a significant difference in the proportion of students from First Nations schools indicating alcohol is a teratogen in the intervention (94.7%) and control (91.6%) groups, p=0.013. There were relatively balanced proportions of students among intervention and control groups indicating that there is no safe frequency of alcohol to consume during pregnancy (68.8% intervention; 71.1% control) and there is no safe time for a woman to consume alcohol during pregnancy (69.8% intervention; 76.8% control). Both groups had the majority of students (77.8% intervention; 78.3% control) indicating that the safest option for a woman when she learns she is pregnant is to stop drinking completely.

Just under half (49.0% intervention; 46.6% control) of students indicated that they had heard of FASD and/or the negative effects of alcohol use in pregnancy before, prior to the survey. Among the listed FASD information sources, the most common ones included: family (55.9% intervention; 44.0% control), school (34.3% intervention; 18% control) and television (24.5% intervention; 20.0% control). The intervention group had a significantly higher proportion of students listing social media/ internet as an information source (16.7% and 2.0%, respectively; p=0.009). Both intervention and control groups had an average of 0.8 FASD information sources listed among students who had specified sources.

With respect to FASD content knowledge, just over half (52.9% intervention; 57.6% control) correctly indicated that individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability. Less than half of students (41.3% intervention; 46.7% control) correctly indicated that FASD in the child can be prevented if the mother stops drinking during pregnancy. Around one-third of students (28.6% intervention; 34.8% control) correctly indicated that FASD is a disability that lasts a lifetime. These differences were non-significant.

Table 7. Baseline (pre-test) survey results for students in the intervention and control groups in First Nations schools (n=298)

Baseline characteristics	Intervention (n=206)	Control (n=92)	p-value
	Frequency (%)	Frequency (%)	
Gender – male	98 (47.5)	38 (41.3)	0.316
Grade			
7	19 (9.9)	58 (65.9)	0.000*
8	127 (66.1)	18 (20.5)	
9	24 (12.5)	1 (1.1)	
10	2 (1.0)	1 (1.1)	
11	6 (3.1)	3 (3.4)	
12	11 (5.7)	2 (2.3)	
Knowledge of alcohol use in general			
Alcohol is a toxin			
Yes	154 (81.5)	68 (81.9)	0.992
Don't know	30 (15.9)	13 (15.7)	
Alcohol is a carcinogen			
Yes	76 (40.2)	29 (34.9)	0.006*
Don't know	92 (48.7)	32 (38.5)	
Knowledge of alcohol use in pregnancy			
Alcohol is a teratogen - yes	179 (94.7)	76 (91.6)	0.013*
No safe frequency of alcohol consumption during pregnancy	130 (68.8)	59 (71.1)	0.646
No safe time to consume alcohol during pregnancy	132 (69.8)	63 (76.8)	0.267
A woman should stop drinking completely once she learns she is pregnant	147 (77.8)	65 (78.3)	0.793
Had heard of FASD and/or the negative effects of alcohol use in pregnancy before	94 (49.0)	41 (46.6)	0.799
FASD information sources**			
Friends	23 (22.6)	9 (18.0)	0.518
Healthcare provider(s)	12 (11.8)	8 (16.0)	0.468

Baseline characteristics	Intervention (n=206)	Control (n=92)	p-value
	Frequency (%)	Frequency (%)	
Radio	4 (3.9)	2 (4.0)	0.981
Family	57 (55.9)	22 (44.0)	0.168
Social media/ internet	17 (16.7)	1 (2.0)	0.009*
Television	25 (24.5)	10 (20.0)	0.535
School	35 (34.3)	18 (16.0)	0.838
Mean number of FASD information sources	0.8 (1.2)	0.8 (1.2)	0.304
FASD content knowledge			
FASD is only seen in babies (incorrect)	24 (11.7)	11 (12.0)	0.940
Individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (correct)	109 (52.9)	53 (57.6)	0.452
FASD is passed on from mother to child (incorrect)	46 (22.3)	32 (34.8)	0.024*
FASD is a disability that lasts a lifetime (correct)	59 (28.6)	32 (34.8)	0.288
FASD only occurs in children whose mothers have alcohol addiction during pregnancy (incorrect)	87 (42.2)	37 (40.2)	0.744
FASD in the child can be prevented if the mother stops drinking during pregnancy (correct)	85 (41.3)	43 (46.7)	0.378
Exposure to alcohol through breastmilk alone cannot cause FASD (correct)	29 (14.1)	9 (9.8)	0.304
Average number of correct items identified (out of 4) – Mean (SD)	1.37 (0.91)	1.48 (0.13)	0.232
Average number of incorrect items identified (out of 3) – Mean (SD)	0.76 (0.89)	0.87 (0.85)	0.166

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated
** - denotes statistical significance at the alpha level of 0.05*
*** - denominator includes only students who indicated prior knowledge of FASD*

With respect to incorrect FASD content knowledge items identified, only a small portion (11.7% intervention; 12.0% control) indicated that FASD is only seen in babies. There was a significant difference found in the proportion of students that incorrectly indicated that FASD is

passed on from mother to child, and this was higher in the control (34.8%) versus the intervention (22.3%) group, p=0.024.

A two-sample t-test did not reveal any significant differences between the intervention and control groups at the pre-test stage with respect to total correct FASD content knowledge score (out of 4) (t=0.7325, df=296, p=0.2322) or the incorrect FASD content knowledge score (out of 3) (t=0.9724, df=296, p=0.1658).

6.3 FASD prevention education curriculum effectiveness (control vs. intervention) in schools serving First Nations students

6.3.1 Pre- and post-test differences in surveys in schools serving First Nations students

Students completed a post-test survey either immediately following the end of the lesson plan (intervention) or three-four days following the pre-test survey (control condition). Table 8 below presents responses from each based on the items that were the same, including demographics, FASD content knowledge and motivations to have and support alcohol-free pregnancies later in life.

With respect to post-test knowledge of alcohol use, there was an increase in both groups for knowledge that alcohol is a toxin. This increased from 81.5% at baseline to 90.8% at the post-test for students in the intervention group (9.3% higher proportion), and from 81.9% at baseline to 85.1% at the post-test for students in the control group (3.2% higher proportion). A paired t-test showed that these increase from pre-test to post-test stage was significant for the intervention group (t=1.7985, df=205, p=0.0368), but not for the control group (t=-0.2074, df=89, p=0.4181) (Figure 5).

With respect to knowledge that alcohol is a carcinogen, students in the intervention had a significantly higher proportion indicating it is a carcinogen (69.7% intervention vs. 53.7% in control), p=0.006. Compared to the baseline percentages, there was an increase in both groups for students agreeing it is a carcinogen. This increased from 40.2% at baseline to 69.7% at the post-test for students in the intervention group (29.5% higher proportion), and increased from 34.9% at baseline to 53.7% at the post-test for students in the control group (18.8% higher proportion). A paired t-test indicated that these scores increased significantly from the pre-test to the post-test stage, for both intervention (t=-3.1969, df=205, p=0.0008) and control (t=-2.7941, df=89, p=0.0032) groups.

Post-survey responses indicate an interesting decrease compared to the pre-test stage, wherein there was a small decrease in the proportion of students in the intervention group (94.7% vs. 91.4%) and a small decrease in the proportion of students in the control group (91.6% vs. 90.1%), of students who indicated that alcohol is a teratogen. A paired t-test indicated that this change was significant for the intervention group (t=5.1415, df=205, p=0.0000), but not for the control group (t=0.6862, df=89, p=0.2472).

Compared to the pre-test stage, there was an increase in the proportion of students in the intervention group who believed there was no safe frequency of alcohol consumption in pregnancy, from 68.8% to 85.5% at the post-test stage. For the control group, there was a slight

decrease (76.8% to 75.6%). A paired t-test revealed that this change was significant for the intervention group (t=-3.8861, df=143, p=0.0001), but not for the control group (t=-1.1494, df=77, p=0.1270).

Increases from the pre-test stage were seen for both intervention and control groups with respect to proportion of students who believed there was no time to consume alcohol in pregnancy (69.8% vs. 84.8% intervention; 76.8% vs. 80.5% control; respectively). A paired t-test revealed that this increase was significant for the intervention group (t=-3.2634, df=143, p=0.0007), but not for the control group (t=-1.0432, df=75, p=0.1501).

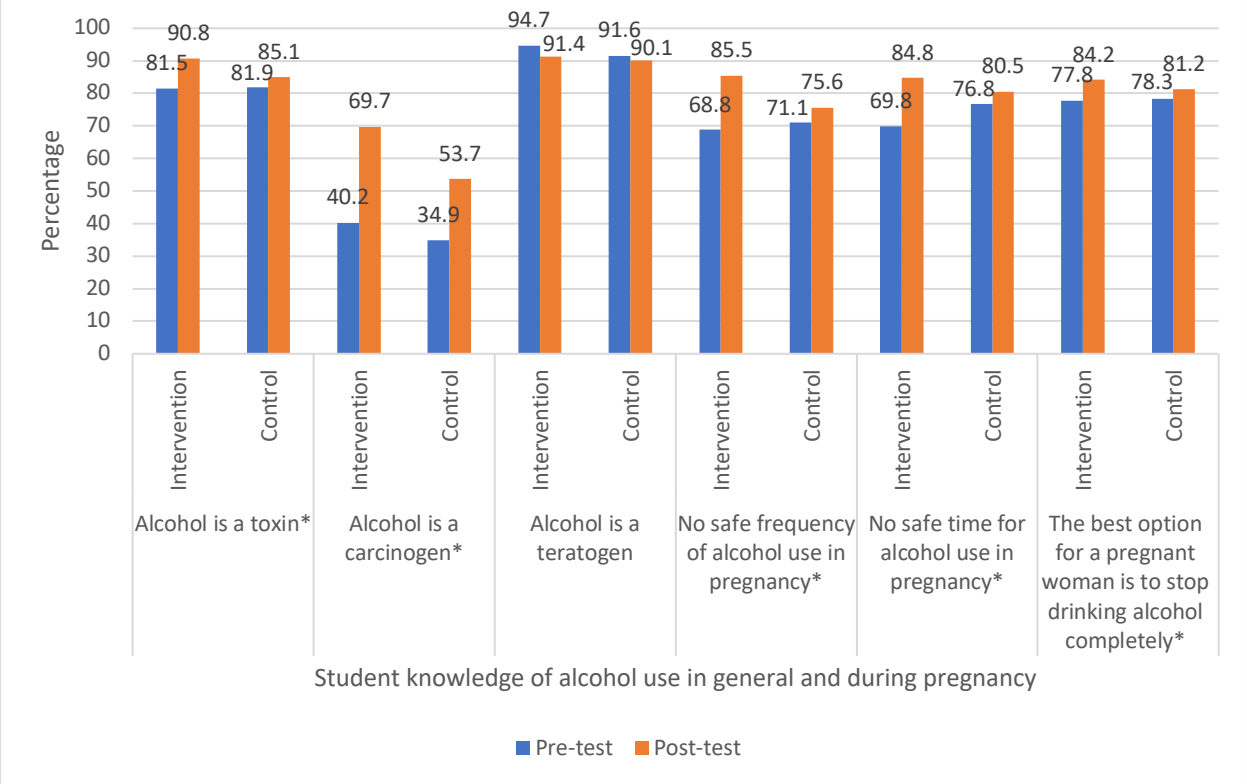

Figure 5. Changes in knowledge of alcohol use in pregnancy among students from First Nations schools in the intervention and control groups (pre-test and post-test)

Increases from the pre-test stage were seen for both intervention and control groups with respect to the belief that a woman should stop drinking completely when she learns she is pregnant (77.8% vs. 84.2% intervention; 78.3% vs. 81.2% control; respectively). A paired t-test revealed that this increase was significant for the intervention group (t=-1.7267, df=143, p=0.0432), but not for the control group (t=-0.5748, df=75, p=0.2836).

Table 8. Post-test survey results for students in the intervention and control groups in First Nations schools (n=298)

Characteristics	Intervention (n=206)	Control (n=92)	p-value
	Frequency (%)	Frequency (%)	
Gender – male	60 (30.8)	12 (20.0)	0.316
Grade			
7	19 (9.9)	58 (65.9)	0.000*
8	127 (66.1)	18 (20.5)	
9	24 (12.5)	1 (1.1)	
10	2 (1.0)	1 (1.1)	
11	6 (3.1)	3 (3.4)	
12	11 (5.7)	2 (2.3)	
Knowledge of alcohol use			
Alcohol is a toxin			
Yes	138 (90.8)	69 (85.1)	0.326
Don't know	10 (6.6)	10 (12.3)	
Alcohol is a carcinogen			
Yes	106 (69.7)	44 (53.7)	0.006*
Don't know	33 (21.7)	18 (22.0)	
Knowledge of alcohol use in pregnancy			
Alcohol is a teratogen - yes	139 (91.4)	73 (90.1)	0.940
No safe frequency of alcohol consumption during pregnancy	130 (85.5)	62 (75.6)	0.248
No safe time to consume alcohol during pregnancy	128 (84.8)	66 (80.5)	0.587
A woman should stop drinking completely once she learns she is pregnant	128 (84.2)	65 (81.2)	0.194
FASD content knowledge			
FASD is only seen in babies (incorrect)	30 (14.6)	26 (28.3)	0.005*
Individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (correct)	117 (56.8)	56 (60.9)	0.510
FASD is passed on from mother to child (incorrect)	66 (32.0)	31 (33.7)	0.778
FASD is a disability that lasts a lifetime (correct)	104 (50.5)	43 (46.7)	0.550
FASD only occurs in children whose mothers have alcohol	86 (41.8)	44 (47.8)	0.328

Characteristics	Intervention (n=206)	Control (n=92)	p-value
	Frequency (%)	Frequency (%)	
addiction during pregnancy (incorrect)			
FASD in the child can be prevented if the mother stops drinking during pregnancy (correct)	82 (39.8)	42 (45.6)	0.344
Exposure to alcohol through breastmilk alone cannot cause FASD (correct)	23 (11.2)	15 (16.3)	0.219
Average number of correct items identified (out of 4) – Mean (SD)	1.58 (1.36)	1.69 (1.33)	0.253
Average number of incorrect items identified (out of 3) – Mean (SD)	0.88 (0.93)	1.09 (0.91)	0.033*
Personally important to them to understand how to have and support alcohol-free and drug-free pregnancies			
Not at all important	8 (5.3)	1 (1.2)	0.037*
Only slightly important	21 (14.0)	4 (5.0)	
Important	60 (40.0)	31 (38.8)	
Extremely important	61 (40.7)	44 (55.0)	
FASD prevention is personally important to them			
Not at all important	4 (4.2)	2 (2.5)	0.546
Only slightly important	6 (6.2)	9 (11.2)	
Important	44 (45.8)	39 (48.8)	
Extremely important	42 (43.8)	30 (37.5)	
Personally important to them to abstain from alcohol and other drugs during pregnancy later in life (females only)			
Not at all important	1 (1.9)	3 (4.8)	0.746
Only slightly important	3 (5.9)	2 (3.2)	
Important	13 (25.5)	14 (22.6)	
Extremely important	34 (66.7)	43 (69.3)	
Not applicable	0 (0.0)	0 (0.0)	
Personally important to them to support others in having alcohol-free and drug-free pregnancies later in life (males only)			
Not at all important	3 (6.1)	0 (0.0)	0.163
Only slightly important	0 (0.0)	1 (7.1)	
Important	22 (44.9)	8 (57.1)	
Extremely important	24 (49.0)	5 (35.7)	
Not applicable	0 (0.0)	0 (0.0)	

Note: percentages reported above reflect number of complete responses for the pertaining survey question, unless otherwise indicated

** - denotes statistical significance at the alpha level of 0.05*

At the post-test stage, a significantly higher proportion of students in the control group incorrectly indicated that FASD is only seen in babies, compared to the intervention group (28.3% vs. 14.6%, p=0.005). Notably, this proportion was higher than at the pre-test stage. All other differences between the intervention and control groups regarding FASD content knowledge, including both correct and incorrect items identified, were not statistically significant at post-test.

With respect to correct FASD content knowledge items identified, there were increases in both groups in the proportion of students correctly indicating that individuals with FASD may have a number of physical, mental, and behavioural problems related to their disability (52.9% pre and 56.8% post for intervention; 57.6% pre and 60.9% post for control). A paired t-test revealed that these increases were not significant for the intervention (t=-0.86, df=205, p=0.1948) or the control groups (t=-0.6526, df=91, p=0.2578).

Similarly, there was an increase in both groups in the proportion of students correctly indicating that FASD is a disability that lasts a lifetime (28.6% pre and 50.5% post for intervention; 34.8% pre and 47.8% post for control). A paired t-test revealed that these increases from the pre-test to the post-test stage were significant for both the intervention (t=-4.9826, df=205, p=0.0000) and the control (t=-2.15, df=91, p=0.0168) groups.

Lastly, students in the intervention group had a slightly lower average number of correct FASD content knowledge responses identified at the post-test (mean=1.58), compared to students in the control group (mean=1.69) (Figure 6). Notably, both post-test means were higher than their respective pre-test values (1.37 for the intervention group and 1.48 for the control group), indicating gains in knowledge over time. A paired t-test revealed that the increase in total correct FASD content knowledge from the pre-test to the post-test was statistically significant for the intervention group (t=-1.86, df=205, p=0.0321) and a borderline significant for the control group (t=-1.6381, df=91, p=0.0524).

With respect to the average number of incorrect FASD content knowledge items identified, students in the intervention group had a lower average score (mean=0.88), compared to students in the control group (mean=1.09) at the post-test stage. Of note, these are both higher than the corresponding means at the pre-test stage (0.76 and 1.09, respectively), which indicates that groups also experienced increases over time in scores for incorrect FASD content knowledge items identified. A paired t-test showed that this increase in total incorrect FASD knowledge score was significant for the control group (t=-1.9895, df=91, p=0.0248), but not the intervention group (t=-1.4958, df=205, p=0.0681).

Questions related to personal motivations for FASD prevention were asked only at the post-test stage. When asked about personal motivations related to FASD prevention, one significant difference was found between the two groups. Students in the control group actually demonstrated a higher proportion of students indicating that it was personally important to them to understand how to have and support alcohol-free and drug-free pregnancies (38.8% important; 55.0% extremely important), compared to students in the intervention (40.0% important; 40.7% extremely important), p=0.037.

The majority of students indicated that FASD prevention was personally important to them (89.6% intervention; 86.3% control). Roughly two-thirds of students surveyed indicated that abstaining from alcohol and other drugs during pregnancy later in life was extremely important to them (66.7% intervention; 69.3% control). Lastly, about half (49.0%) of students in the intervention group believed that it was personally important to them to support others in

having alcohol-free and drug-free pregnancies later in life, with this being lower in the control group (35.7%), though it is not significant.

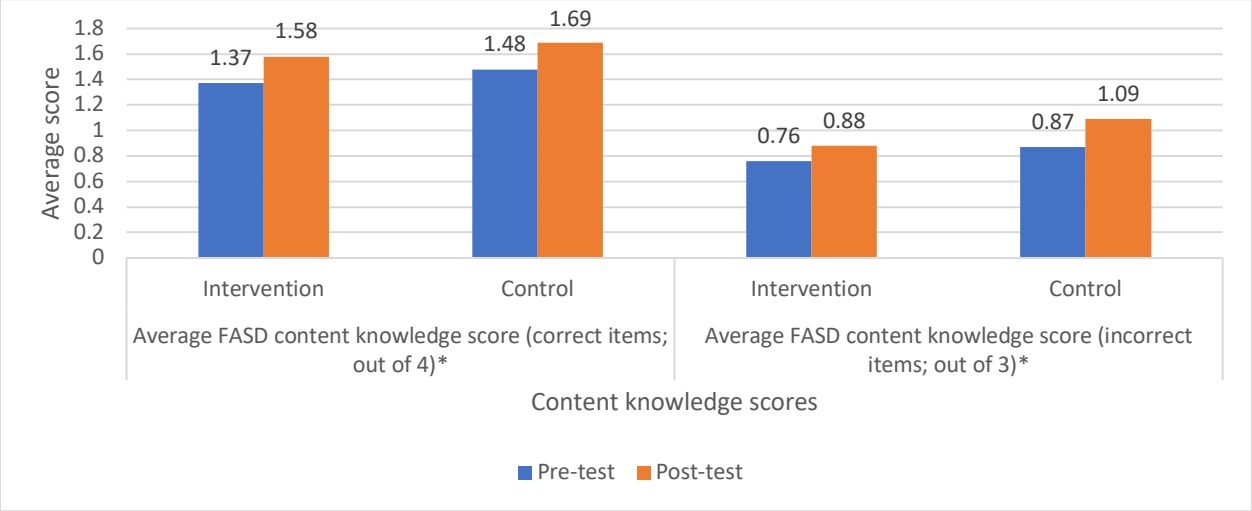

Figure 6. Changes in FASD content knowledge scores among students in the intervention and control groups from First Nations schools (pre-test and post-test)

6.3.2 Linear regression analyses for schools serving First Nations students

To examine the relationship between the assigned condition (intervention or control) and several student outcomes, including FASD content knowledge and motivations related to FASD prevention, linear regression models were conducted (Table 9). Based on the descriptive statistics reflecting group differences and inconsistencies in implementation, covariates were chosen for these models, including gender, grade, previous knowledge of FASD (yes/no at baseline), and the total number of units attended (0-3 for intervention; 0 for control). A positive relationship was observed, with participation in the intervention condition significantly associated with higher FASD content knowledge scores (correct items identified) at the post-test stage, $F(5,266)=12.64$, $R^2=0.19$, $p=0.000$.

Using the same covariates, we examined additional outcome variables related to student motivation for FASD prevention in relation to the intervention condition.

In the adjusted model, no significant positive associations were identified between the intervention condition and students' self-reported importance of having and supporting alcohol-free pregnancies, the perceived importance of FASD prevention, or the perceived importance of maintaining alcohol-free and drug-free pregnancies later in life.

Table 9. Parameters of linear regression models examining the relationship between study condition (intervention) and outcome variables at the post-test stage in schools serving First Nations students

Student outcome variable	R^2, F-test value	p-value
Correct FASD content knowledge score	$R^2 = 0.1920$, $F(5,266) = 12.64$	0.000*
Level of importance of having and supporting alcohol-free pregnancies	$R^2 = 0.0467$, $F(5,213) = 2.08$	0.0685
Level of importance of FASD prevention	$R^2 = 0.0122$, $F(5,166) = 0.41$	0.8409
Level of importance of abstaining from alcohol and other drugs during pregnancy	$R^2 = 0.0680$ $F(5,103) = 1.50$	0.1951
Level of importance of supporting others in having alcohol-free and drug-free pregnancies later in life	$R^2 = 0.1333$, $F(5,157) = 1.75$	0.1372

Note: linear regression models have been adjusted for gender, grade, previous knowledge of FASD, and the total number of units attended
** - denotes statistical significance at the alpha level of 0.05*

6.4 Students' perceptions of the FASD prevention education curriculum in schools serving First Nations students (intervention only)

Several post-test survey items pertained only to the intervention survey design, related to attendance, their views on the FASD prevention education curriculum content, their perceptions of their own learning, and any suggestions they have for improving the curriculum. These items were examined by gender responses at the pre-test stage for consistency (Table 10).

Only 10.5% of females and 24.3% of males had indicated on the post-test survey that they were present for all three units in class, which is a significant difference between the genders (p=0.015). About one-fifth of students (22.8% of females and 18.4% of males) indicated that Unit 1 was helpful to their learning, which focused on the impacts of alcohol use on teen wellness from a holistic perspective. Just over one-third (38.0% of females and 35.7% of males) indicated that Unit 2 was helpful, which focused on the impacts of alcohol use specifically in pregnancy, including FASD. Interestingly, male students were significantly more likely to indicate that Unit 2 was helpful, which focused on strategies to support alcohol-free and drug-free pregnancies (14.8% of females; 27.6% of males, p=0.025).

Over half of students who participated in the First Nations version of the developed lesson plan indicated that their understanding of the impacts of alcohol use and FASD had either significantly improved (22.8% of females; 25.6% of males) or moderately improved (39.2% of

females; 38.0% of males) following the lesson plan, with no significant difference based on gender. The overwhelming majority of students (88.1% of females and 85.5% of males) expressed that they felt they learned useful information in the lesson plan that will be helpful to them later in life, in adulthood. Specifically, 71.2% of females and 64.6% of males expressed that they feel Unit 3 prepared them well to have and support alcohol-free pregnancies later in life. The majority of students (70.1% of females; 60.7% of males) indicated that they are likely to use these strategies to abstain from alcohol in youth and support alcohol-free pregnancies now and later in life. No significant differences were found based on gender.

Table 10. Perceptions of the FASD prevention education curriculum among students in the intervention condition among schools serving First Nations (n=206)

Characteristics	Intervention (n=206)			p-value
	Female (n=162)	Male (n=136)	Total (N=298)	
Present for all 3 units in class	17 (10.5)	33 (24.3)	50 (16.8)	0.015*
Units that were helpful to your learning (check all that apply)				
Unit 1: Impacts of alcohol use on teen wellness	37 (22.8)	25 (18.4)	62 (20.8)	0.345
Unit 2: Impacts of alcohol use in pregnancy and Fetal Alcohol Spectrum Disorder (FASD)	41 (25.3)	35 (25.7)	76 (25.5)	0.933
Unit 3: Supporting alcohol-free and drug-free pregnancies	16 (9.9)	27 (19.9)	43 (14.4)	0.015*
None	5 (3.1)	10 (7.4)	15 (5.0)	0.093
How do you feel that your understanding of alcohol use and FASD has changed after the lesson?				
Significantly improved	18 (22.8)	18 (25.6)	36 (24.0)	0.648
Moderately improved	31 (39.2)	27 (38.0)	58 (38.7)	
Slightly improved	22 (27.9)	15 (21.1)	37 (24.7)	
No change	8 (10.1)	11 (15.5)	19 (12.7)	
A lesser understanding than before	0 (0.0)	0 (0.0)	0 (0.0)	
Do you feel you learned useful information in this class that will be helpful to you later in life (i.e., adulthood)?				
Yes	59 (88.1)	53 (85.5)	112 (86.8)	0.569
No	8 (11.9)	8 (12.9)	16 (12.4)	
Can't tell	0 (0.0)	1 (1.6)	1 (0.8)	
Unit 3 prepared me well to have and support alcohol-free pregnancies				
Yes	47 (71.2)	42 (64.6)	89 (67.9)	0.658
No	7 (10.6)	7 (10.8)	14 (10.7)	
Somewhat	12 (18.2)	15 (23.1)	27 (20.6)	
Can't tell	0 (0.0)	1 (1.5)	1 (0.8)	
I am likely to use these strategies to abstain from alcohol in youth and support alcohol-free pregnancies now and later in life				

Characteristics	Intervention (n=206)			p-value
	Female (n=162)	Male (n=136)	Total (N=298)	
Yes	47 (70.1)	37 (60.7)	84 (65.3)	0.650
No	5 (7.5)	8 (13.1)	13 (10.2)	
Somewhat	14 (20.9)	15 (24.6)	29 (22.7)	
Can't tell	1 (1.5)	1 (1.6)	2 (1.6)	

6.4.2 Written feedback from students in the intervention condition from schools serving First Nations

Four main themes were identified in the responses from participating students in schools serving First Nations communities who gave feedback on the lesson plan and suggestions for how to improve.

1. **<u>No suggestions identified; okay or good as is</u>**
    - "Nothing really; everything is perfect"
    - "Sorry I don't have any suggestions; I think the FASD prevention education lesson is good just the way it is"
    - "no this was good!"
    - "In my opinion, y'all did a great job"
    - "It helps you learn new strategies and teaches you not to drink during pregnant.
    - "No I do not. I feel like this was explained to the best and I feel like it was really easy to follow along and I took a lot from this for the future."
    - "No I don't. It was really well put together and I really did feel welcomed because of the input of Ojibwe and Anishnaabe teachings. The 7 grandfather teachings is the way to a healthy life, it's what unites us all. "
    - "No I think the lesson was well planned and gave great information about FASD. I learned quite a bit about FASD for the future this lesson will always be in mind to have a safe and health baby and fetus in the future! "
    - "I do not have any suggestions to improve it was amazing"

2. **<u>To make the presentation more visually appealing and/or engaging</u>**
    - "I think you should have more pictures"
    - "Do more work where we get to do something or people who has it and someone our age"
    - "Faster reading speed. And more extra videos. "
    - "None"
    - "improve visuals, otherwise it was great"
    - "They can add shocking images so they scare people"
    - "Incorporate more visuals, for the impact of shock value, allow the presentation to have a few more engaging points to hold attention, and maybe cut down on time.

Other than that, this presentation was extremely educational and made many quality points. Well done. ”

- “could use better visuals and better way to show the knowledge”
- “have more visuals”
- “make less boring”
- “Yes I have suggestions to how the lesson can be improved. The visual aspect can be more interactive and the speaker should try to sound like they aren't just reading a script. ”
- “less lame zzzzz”
- “boring - make videos less”
- “background music”
- “visuals, more diagrams”
- “They repeat the same information a lot”

3. **Make the curriculum more widespread and/or increase FASD awareness in general**
    - “They should take it more seriously. It can seriously save future babies.”
    - “People could talk to others about the topic and help get clean”
    - “We can focus on education raising awareness for FASD”
    - “We can focus on education, raising awareness and implementing clear alcohol labeling”

4. **Add additional components into the presentation**
    - “Possibly by understanding the victims of physical, mental etc issues and learning how to care for it”
    - “talk more about the harmful effects of alcohol use and how it can affect the human body”
    - “Maybe show a video of a mom and her baby so we can see both of them. And more videos because I liked them and they helped.”
    - “give testimony”
    - “I would say stay away from alcohol and drugs because it will mess up your life”

6.5 Teachers’ perceptions of the FASD prevention education curriculum

Three teachers from the classes in First Nations schools who participated in the intervention, completed the teacher survey. Responses indicated a range of number of years of teaching experience (2-18 years), and were filled out by both middle school and secondary teachers. Two of the teachers indicated that they were personally present for all three units of the lesson plan. All participating teachers indicated that Unit 2 was helpful to their students, while there were varying responses for if Units 1 and 3 were helpful. All teachers indicated that the lesson plan helped at least somewhat to improve their own general knowledge of alcohol use in pregnancy and FASD. All teachers indicated that the Teacher Guide document helped them feel prepared to facilitate the discussions required in the lesson plan.

The written feedback from teachers overwhelmingly included suggestions to shorten the lesson plan, particularly for middle school students, and to make it more visually appealing and

engaging. All teachers suggested to condense the lesson plan into chunks such that it could be more interactive, with some suggesting that more student discussions and interactive activities could increase student learning from the lesson plan itself. All teachers recommended this lesson plan to be included in the Ontario Health curriculum for both middle school and high school grades, upon modification as suggested by them.

6.6 Main findings for First Nations schools

Analyses examining pre-test and post-test surveys in control and intervention groups demonstrated that the FASD prevention education curriculum is effective in the following educational aspects for students in schools serving First Nations communities:

- Teaching students that alcohol is a toxin
- Teaching students that alcohol is a teratogen
- Teaching students there is no safe frequency of alcohol consumption during pregnancy
- Teaching students there is no safe time to consume alcohol during pregnancy
- Teaching students that the safest option for a pregnant woman is for her to stop drinking alcohol immediately;
- Increasing overall content knowledge of FASD (e.g., that FASD is a lifelong disability)

Based on post-test surveys only (not asked at baseline), we can see that the intervention is associated with higher proportions of students indicating that it is personally important to them to understand how to have and support alcohol-free pregnancies

Linear regression analyses found that when adjusted for gender, grade, previous knowledge of FASD (prior to the study) and the total number of FASD prevention education curriculum units attended, the intervention is significantly associated with a higher total FASD content knowledge score. Based on these adjusted models, the intervention was not associated with a higher level of student-indicated importance of having and supporting alcohol-free pregnancies; a higher level of student-indicated (personal) importance of FASD prevention; or a higher level of student-indicated (personal) importance of abstaining from alcohol and other drugs during pregnancy.

A great deal of positive feedback was received on the FASD prevention education curriculum used in the intervention, from students and teachers, including a sense of welcome from the cultural teachings related to the Seven Grandfather teachings. These qualitative data (un-quantified) revealed that many students believed the FASD prevention education curriculum did not need improvement, and that the curriculum needs to be more widespread, with more large-scale efforts to increase FASD awareness in general, both during and after school. In fact, the majority of teachers surveyed recommended this lesson plan to be included in the Ontario Health curriculum for both middle school and high school grades, upon modification as suggested by them.

Feedback from students and teachers also revealed opportunities to improve the curriculum used in the intervention, including to shorten the length of the presentation and to make it more visually appealing, engaging and/or interactive. Additional suggestions were

provided around adding components to the curriculum such as testimony, shocking images or videos of birth mothers with FASD.

7.0 SUMMARY AND CONCLUSIONS

7.1 Main findings

Evaluation of the effectiveness of the FASD school-based pilot project revealed that this program significantly improved various key outcomes:

1. Increased FASD content knowledge (mainstream and First Nations)
2. Increased student motivations to have and support alcohol-free pregnancies later in life (urban only).

Pre-test and post-test analyses showed that for students in urban schools (intervention vs. control), the FASD prevention education curriculum was effective in teaching students about the risks of alcohol use in general, and during pregnancy, as well as in increasing their overall content knowledge of FASD. Linear regression models indicated that the curriculum was significantly associated with higher content knowledge of FASD and higher proportions of students indicating it is personally important to them to understand how to have and support alcohol-free pregnancies and that FASD prevention is personally important to them.

Pre-test and post-test analyses for First Nations schools (intervention vs. control) shows that the FASD prevention education curriculum was effective in teaching risks of alcohol use in general, and during pregnancy, as well as in increasing their overall content knowledge of FASD. The intervention was associated with higher proportions of students indicating that it is personally important to them to understand how to have and support alcohol-free and drug-free pregnancies. Linear regression models showed that the FASD prevention education curriculum was significantly associated with higher content knowledge of FASD.

Students in the intervention group as compared to control group:

- demonstrated greater understanding of the risks of PAE and FASD;
- were better equipped to make healthier choices regarding alcohol use and to support peers in preventing substance-related harm.

Findings from rural schools (control condition only) showed that practice from testing in this context (two subsequent surveys) seems to increase the proportions of students indicating a belief that there is no safe time or frequency of alcohol consumption during pregnancy and that the safest choice is for a woman to stop drinking completely once she learns she is pregnant. Interestingly, testing revealed a decrease in the overall FASD content knowledge scores for both incorrect and correct items identified.

A great deal of positive feedback was received on the FASD prevention education curriculum (both versions) used in the intervention, from students and teachers. These qualitative data (un-quantified) revealed that many students believed the curriculum did not need improvement, and that the curriculum needs to be more widespread, with more large-scale efforts to increase FASD awareness in general, both during and after school. In fact, the majority of teachers surveyed recommended this lesson plan to be included in the Ontario Health curriculum for both middle school and high school grades, upon modification as suggested by them.

Feedback from students and teachers also revealed opportunities to improve the curriculum by shortening the length of the presentation and to making it more visually appealing, engaging and/or interactive.

The success of this FASD school-based program underscores the need for continued integration of this curriculum in school settings.

7.2 Lessons learned

Cultural adaptation of the NOFAS lesson plan and creation of two turnkey lesson plans (one mainstream, one First Nations):

1. Cultural adaptation of a school-based FASD prevention initiative requires a systematic, iterative and collaborative effort among a diverse group of professionals, including social workers, educators, Knowledge Keepers, Elders, women's substance use researchers, harm reduction workers and individuals with lived/living experience of alcohol use during pregnancy, prenatal substance exposure and FASD.
2. Creation and integration of materials for a turnkey lesson plan that imposes minimal administrative burden and is cost-free for students and teachers, requires a process of at least several months, with adequate pilot-testing involving students.
3. Implementation of the lesson plan into school boards requires many rounds and iterations of CAMH research ethics board review and approval with external research review committees at school boards. School boards have varying external research priorities, and time/administrative demands for teachers and principals.
4. Both versions of the current lesson plan (mainstream; First Nations) are effective in increasing FASD content knowledge and increasing student motivations to have and support alcohol-free and drug-free pregnancies and contribute to FASD prevention in general.
5. The FASD prevention education curriculum has yet to be implemented and evaluated in a rural setting, but there is evidence to suggest that even asking students about FASD repeatedly, may increase content knowledge and motivations around FASD prevention in the rural setting.

7.3 Strengths and limitations

This project includes several strengths overall with respect to FASD prevention education curriculum adaptation, implementation and evaluation. This is the first Ontario study to modify, implement and evaluate the FASD prevention education curriculum for and within the Ontario setting using a number of quantitative and qualitative pre-test and post-test measures. This study developed two turnkey lesson plans: one for students in urban and rural schools; and that was carefully planned and designed for students from First Nations communities. These turnkey lesson plans included minimal teacher and administrative burden on school staff. This study also developed novel survey instruments to measure FASD prevention education curriculum fidelity and effectiveness with respect to its intended effects on student learning and student self-efficacy for FASD prevention.

With respect to evaluation, this study's strengths included:

- evidence of effectiveness - can lead to a reduction in alcohol use in general and during future pregnancy and related harm, including FASD;
- can reach a large number of students in school in a short period of time, providing intervention to children and adolescents across various demographics.
- cost-effective as have the potential to prevent costs related to the negative consequences of harmful drinking and alcohol use during pregnancy, including FASD.
- early intervention, preventing alcohol-related issues before they arise
- can foster a collective effort among schools, principals, teachers, parents, and students to promote healthier behaviors

This study also included several limitations, which can be understood in the study phases:

1. The lesson plan was designed for both middle school and high school students in both lesson plan categories (mainstream; First Nations).
2. Design of the lesson plan for First Nations students offered the unique perspective of an Anishnaabe Knowledge Keeper, which may not be as relevant for students in other Indigenous categories (e.g., Inuit or Metis) or non-Indigenous-identifying students in the same targeted classes/schools.
3. Implementation of the study in rural schools did not include intervention classes, which limits the evaluation of the intervention in rural schools.
4. Participating rural schools may fall into more suburban categories, as these were part of some of the same school boards serving urban schools. This limitation was due to a lack of ethics approval from more remote school boards based on ethics applications that were submitted and rejected.
5. Researcher observations were conducted only in some intervention classes, all of which were in First Nations schools; no observations took place in urban schools. This may limit the ability to assess student engagement, which contributes to the overall understanding of program fidelity and consistency of the intervention delivery.
6. This program may not account for the unique needs of all individual students, such as those with pre-existing alcohol use problems or specific cultural considerations.
7. Long-term impact of the program is unknown. Sustaining behavioral change over time can be challenging without ongoing reinforcement and support.
8. The effectiveness of this program can vary depending on how consistently and thoroughly it would be implemented across different schools and by different teachers.
9. This program may not be as effective as it would be complemented by broader community (e.g., national policy on restrictions on alcohol availability, advertisement, drinking in public, raising prices on alcohol) or family involvement.
10. Some students may resist participation if they perceive the program as irrelevant or not aligned with their personal experiences or attitudes.

8.0 RECOMMENDATIONS

8.1 Future directions for implementation

As this FASD prevention education curriculum has demonstrated effectiveness in increasing student FASD content knowledge (urban and First Nations) and in increasing students motivations to have and support alcohol-free pregnancies (urban and First Nations), an implementation of the program on a larger scale is recommended. The FASD prevention education curriculum can be expanded to additional jurisdictions across Ontario to start, and can be added to other provinces and territories, pending review by jurisdictional Health curricula experts. Research shows that school-based interventions are most successful when implemented as primary prevention programs, with the strongest effects observed in children and adolescents who have not yet started to consume alcohol (114). This FASD prevention education curriculum can also be expanded to earlier grades and can be implemented on a larger scale, and this recommendation stems from the results of the evaluation, as well as the feedback from students and teachers that emphasizes the importance of large-scale awareness and education initiatives.

The results of the project demonstrated the effectiveness and feasibility of implementing the FASD prevention education curriculum, delivered as a turnkey lesson plan, in selected urban, rural and First Nations schools in Ontario. This report, which also serves as an implementation tool kit, presents findings from both process and outcome evaluations to support the replicability of the FASD prevention initiative across other provinces and territories of Canada. PAE and FASD are public health issues of national relevance. This project has developed culturally appropriate, evidence-based FASD prevention educational content that is suitable for implementation in diverse educational settings across all provinces and territories of Canada.

8.2 Future directions for research

Further studies should focus on adapting the FASD prevention education curriculum for younger age and examining long-term outcomes to assess its sustained impact. Evaluating long-term outcomes focused on decreasing PAE and reducing the incidence and prevalence of FASD are outside the scope of this project. In order to determine the interventions impact on prenatal substance use, a long-term follow up survey would be disseminated to individuals who were exposed to the intervention. Future studies can pursue ethics approval to continually contact intervention participants (e.g., every five years) via surveys, interviews, or other data sources to determine if participants:

- abstained from alcohol and other substance use during pregnancy;
- retained information on the risks of alcohol and other substance use during pregnancy; and
- experienced fewer perceived barriers to abstaining from alcohol and other substance use during pregnancy due to increased personal awareness of the risks associated with these behaviours.

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