EXPLORING DETERMINANTS OF CANCER-RISK BEHAVIOUR IN YOUTH: PROCESS EVALUATION OF AN ADAPTED ALTERNATIVE SCHOOL MINDFULNESS PROGRAM

LESLIE PRENOSLO
Bachelor of Science, University of Alberta, 2012

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LESLIE PRENOSLO

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Dr. C. Currie	Associate Professor	Ph.D.
Dr. J. Copeland	Professor	Ph.D.
Thesis Co-Supervisors		
Dr. R. Crowder	Assistant Professor Emerita	Ph.D.
Thesis Examination Committee Member		
Dr. T. Luft	Assistant Professor	Ph.D.
Thesis Examination Committee Member		
Dr. P. Kellett	Assistant Professor	Ph.D.
Chair, Thesis Examination Committee		

Abstract

Childhood stress has been linked to an increase in cancer-risk behaviours and cancer rates. Addressing health-risk behaviours in adolescence can create healthy lifelong habits. Mindfulness focuses on cultivating present-moment awareness and may offer a healthy coping strategy to youth. This thesis focused on process evaluation of a mindfulness intervention delivered to 17 junior high students attending an alternative school. The main objectives were to assess program adaptation, youth engagement, and youth experience. Technology was successfully integrated into the program. Results were inconclusive on whether adaptations to increase participant safety were successful. Youth were engaged in sessions, though some facilitation improvements were suggested. Participants experienced mindfulness as a quiet time, novel to typical busyness. Youth understandings of mindfulness increased post-intervention, with youth describing it as a tool for relaxation and coping. Findings can be used to strengthen the delivery of mindfulness interventions to youth within alternative schools.

Preface

The COVID-19 pandemic impacted this thesis. I had originally designed an outcome evaluation focused on the impacts of a youth mindfulness intervention on cancer-risk behaviours, specifically tobacco-use and sugar-sweetened beverage consumption. The intervention was completed before the pandemic was declared by the World Health Organization; however, schools were ordered to close while post-intervention data collection was underway. The decision was made to not continue with online or phone data collection as much change would have happened in the lives of youth during this stressful time that would impact my assessment of the intervention's effectiveness for youth post-intervention. Thus, this thesis focused on a process evaluation of the intervention exclusively. Six students completed both pre and post data collection appointments, and these data were incorporated into my evaluation of the program. I had also planned to investigate the program from the perspective of Indigenous and non-Indigenous students separately; however, this could not be done with the small number of post-intervention interviews.

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List of Abbreviations

ACC	Anterior Cingulate Cortex
ACEs	Adverse Childhood Experiences
BMI	Body Mass Index
CHIME	Comprehensive Inventory of Mindfulness Experiences
CRIS	Cancer-Risk Interventions Study
DERS	Difficulties in Emotion Regulation Scale
DERS-SF	Difficulties in Emotion Regulation Scale Short Form
HREBA	Health Research Ethics Board of Alberta
MARS	Mobile App Rating Scale
MBCT	Mindfulness-Based Cognitive Therapy
MBSR	Mindfulness Based Stress Reduction
PTSD	Post-traumatic Stress Disorder
SAMHSA	Substance Abuse and Mental Health Services Administration
S-ART	Self-awareness, Self-regulation, and Self-transcendence
SCARED	Screen for Children Anxiety Related Disorders
SIgA	Salivary Secretory Immunoglobulin A
YRBS	Youth Risk Behaviour Survey

CHAPTER 1: INTRODUCTION AND OVERVIEW

1.1 Background

Adolescence is a time where health-risk behaviours tend to develop and extend into adulthood, potentially causing later diseases, such as cancer.[1–4] Cancer is the top cause of mortality in Canada.[5] Older adults are most likely to be diagnosed with cancer, however the risk behaviours linked to the disease start much earlier in life.[6] It is estimated that 40% of new cancer cases in Alberta could be prevented through modifiable lifestyle and environmental risk factors.[7] Smoking tobacco and carrying excess body weight are amongst the top cancer-risk factors in Alberta and worldwide.[7] Emerging evidence also highlights habitual consumption of sugar-sweetened beverages as a risk factor associated with increased cancer incidence and reoccurrence, as well as with risk factors for cancer (e.g. type 2 diabetes, obesity).[8–10] In 2009-2011, 20% of Canadian teenage youth's weights were classified as overweight and 10% as living with obesity.[11] Daily soft drink consumption was reported by 13% of Canadian youth in 2010.[12] In 2016-2017, 10% of Canadian youth were estimated to have used any tobacco product in the past month.[13] Cancer-risk factors, including smoking and carrying excess body weight, have been linked to trauma.[14–18] There is a need to move beyond educational messaging alone, addressing trauma and the underlying role it plays in why youth engage in cancer-risk behaviours, before habits become ingrained.[4,19] The Cancer-Risk Interventions for Youth (CRIS-Youth) study was designed to assess participation in a mindfulness intervention and engagement in cancer-risk behaviours. The present thesis focused on process evaluation for the CRIS-Youth pilot study. The main objectives were to understand program adaptation, youth engagement and

the overall experience of youth participating in a mindfulness intervention delivered to junior high students attending an alternative school.

1.1.1 The link of childhood trauma and health outcomes

Toxic stress can occur as a result of experiencing events that are uncontrollable, chronic or experienced by children without access to a caring support system.[20] Frequent or prolonged activation of the body's stress management system can occur, affecting brain development.[20] The relationship between multiple traumas and disease in adulthood was first investigated in the Adverse Childhood Experiences Study published by Felitti et al. in 1998.[21] This posed a shift from a previous focus on single traumas in childhood. Childhood traumas, specifically Adverse Childhood Experiences (ACEs), were divided into three categories in the study: abuse, household challenges such as addictions or violence, and neglect.[21] A significant dose-response was found between ACEs and cancer.[21] The ACEs pyramid (Figure 1) conceptualizes how childhood trauma is theorized to cause increased morbidity and mortality.[21] ACEs can first lead to social, emotional and cognitive impairment which can lead to the adoption of health-risk behaviours as coping mechanisms. These health-risk behaviours increase risk for a variety of diseases which can lead to early death. Looking at health-risk behaviours in isolation as causing disease fails to consider factors underlying these behaviours. For example in considering the link between smoking and disease, smoking may be viewed as the problem by the medical system but for some individuals that might be a solution for coping with an underlying stressor.[21] Considering the entirety of the ACE pyramid provides a broader picture of health risks, offering potential opportunities to stop progression through the ACE pyramid or to target multiple levels within an intervention.

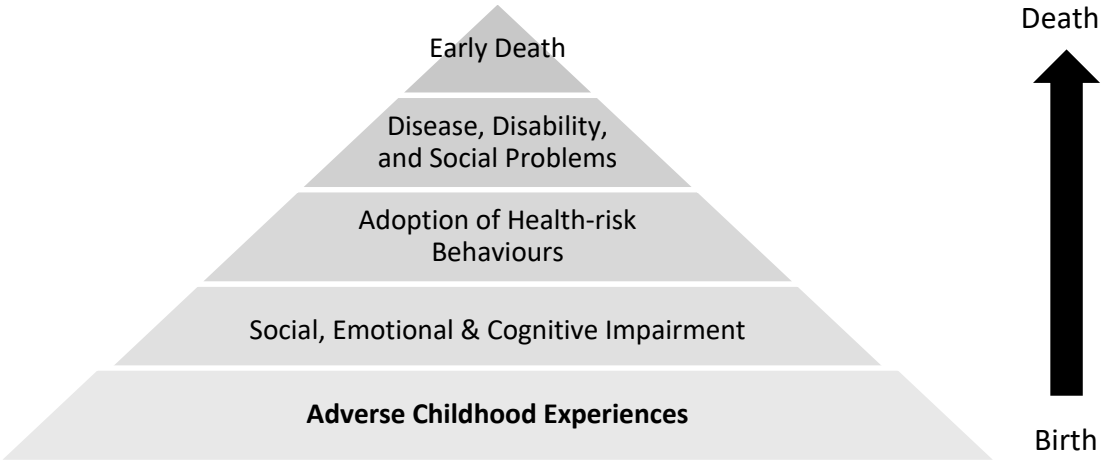


Figure 1. Re-creation of the conceptual framework of the Adverse Childhood Experiences Pyramid. Figure reprinted from the American Journal of Preventive Medicine, Vol 14(4), Felitti VJ, Anda RF, Nordenberg D, Williamson DF, Spitz AM, Edwards V, et al. Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The Adverse Childhood Experiences (ACE) Study.[21] Page 256, Figure 2. Copyright 1998, with permission from Elsevier. (See Appendix A Copyright Clearance.)

1.1.2 Childhood trauma and the adoption of cancer-risk behaviours

Many current health interventions attempt to have people make the improbable change from an immediate coping solution to a behaviour that is motivated by long-term health benefits.[21] There is a call for public health to shift focus to consider ACE-informed approaches to build greater resilience in people who have experienced trauma.[22] In the original ACEs study, the prevalence of obesity and current smoker status both consistently increased with an increasing ACE score, with the highest rates seen in the group reporting four or more ACEs.[21] Unhealthy behaviours can become coping strategies for youth experiencing toxic levels of stress in their lives.[18] Youth 10-19 years (adolescents) experience more activation in the limbic brain region than adults when in stressful situations, especially when surrounded by peers.[23] The limbic brain region is associated with reward and pleasure, while the prefrontal cortex is associated with executive control functions such as emotional regulation and decision making. The prefrontal cortex is slower to develop than the limbic system; particularly during the early to mid-adolescent years,

this developmental imbalance may explain heightened levels of risk taking behaviours that are driven by emotions and yearning for reward.[23] Children exposed to maltreatment have also been shown to have alterations in regions of the prefrontal cortex associated with emotion-driven behaviours.[15] Research suggests cancer-risk behaviours are higher among youth attending alternative high schools.[24] Interventions teaching youth practical skills to regulate emotions and alleviate negative mood states may help reduce engagement in cancer-risk behaviour.

1.1.3 Smoking and cancer-risk

The link between smoking and cancer is an established scientific fact recognized in systematic reviews examining several types of cancer (such as lung, colorectal, ovarian and gastric).[25–28] In a meta-analysis pooling results from 216 case-control studies, current smokers had significantly higher risk ratios for several cancer types (including upper digestive tract, oral cavity, esophagus, pharynx, liver, stomach, pancreas, cervical, kidney and lung).[29] The highest risk ratio was seen for lung cancer among current smokers at 9.0 (CI = 6.7-12.1) and was still significant for former smokers at 3.9 (CI = 2.8-5.3). Stress is known to play a key role in whether or not teens smoke.[30,31]

1.1.4 Sugar-sweetened beverage consumption and cancer-risk

Sugar-sweetened beverage consumption can affect body weight and cancer-risk. A 2008 systematic review and meta-analysis linked increased body mass index (BMI) in adulthood to increased risk for a variety of cancer types.[32] Sugar-sweetened beverage consumption is one factor that can lead to excess body weight.[33] In a review including 13 systematic reviews and meta-analysis, Keller et al. found that nine (70%) of the studies found a direct link between sugar-sweetened beverage consumption and weight gain in adolescents.[34] Two studies stated a conclusion could not be drawn without more research and the other two concluded there was no

significant association. In a group of 547 school aged youth, each additional serving of sugar-sweetened beverage consumed was linked to an increase in BMI and increase in frequency of obesity.[35]

A simulation model was created in 2017 to estimate the attributable burden of sugary drinks (including sugar-sweetened beverages and fruit juices) on various diseases in Canada using data from the 2004 Canadian Community Health Survey and the 2015 Global Burden of Disease Study. The results estimated that over 100,000 new cancer cases over the next 25 years will be attributable to sugary drink consumption.[36] A large prospective cohort study in Australia looked at self-reported consumption of sugar-sweetened and artificially sweetened soft drinks, and later risk for obesity-related cancers.[37] Hazard ratios for obesity-related cancers increased with increasing consumption of sugar-sweetened beverages. This association was observed with sugar-sweetened beverages but not with artificially sweetened beverage consumption, despite higher consumption of either category of drinks being related to higher waist circumference. The results were stratified for other variables such as sex, physical activity levels, and Mediterranean Diet score. The authors suggested their findings further justified efforts to minimize sugar-sweetened beverage consumption. It is novel to research the linkage of stress, mindfulness and sugar-sweetened beverage consumption; however, the hypothesis is supported by physiological mechanisms. In a state of chronic stress, cortisol levels in the body are elevated and preference for sugar and fat is heightened.[38]

1.1.5 Mindfulness training

Research suggests mindfulness interventions can promote emotional regulation within the adolescent brain.[39,40] Mindfulness can be described as present moment awareness that is non-judgmental and non-reactive.[41] Mindfulness interventions have been associated with positive

effects on health, academic and psychosocial outcomes.[42–45] As the popularity of mindfulness grows, interventions are expanding to target at-risk youth such as those in foster care, prisons or survivors of interpersonal trauma.[46–51] Mindfulness has been proposed as a mechanism that may facilitate healing in the human brain from stress and post-colonial trauma.[39,40]

The Learning to BREATHE Program. The mindfulness program selected for this thesis study was Learning to BREATHE*: A Mindfulness Curriculum for Adolescents*.[52] The program aims to make mindfulness relevant to high-school aged youth's lives, placing an overarching focus on empowerment.[52] It aims to build awareness of stress and triggers, something Broderick suggests is often missing from stress management programs.[53] This lays the foundation to then practice awareness and potentially reduce the automatic, often negative responses to stress. Self-compassion is emphasized, encouraging awareness in youth without the need to fix or change anything about themselves.[53] The curriculum focuses on an overall theme of empowerment, guiding youth to develop inner-strength for navigating thr stress of daily life. The original studies using Learning to BREATHE took place in private schools and upper-class public schools. Improvements were seen in emotional regulation in pre and post interventions scores.[54,55] The program has since been used with at-risk high school populations with results suggesting it promotes emotional regulation and protects resilience.[54–57] More detail on how Learning to BREATHE has been used in the literature is covered in Chapter 2. The Learning to BREATHE program explores six themes: body, reflection on thoughts, emotions, attention, tenderness and acceptance, and healthy habits. For this intervention a first session was added to provide a general introduction to mindfulness and how it can be a helpful tool. A final session was added that focused on the overarching theme of empowerment. This was used to reinforce the message of inner strength, being in control and honing healthy coping skills.

Adaptations to use technology. Mindfulness apps were used to deliver many of the mindfulness practices, rather than the written-out practices the curriculum suggested the facilitator read. The apps were used to familiarize youth with practices they could continue to access on their own after the program. Apps stayed true to each theme's suggested practices to preserve the integrity of the program. Two apps, *Stop, Breath and Think* and *Smiling Mind*, were used for the program. Both are free to download and available on Apple and Android devices. They can also be accessed through an internet browser. Chapter 2 provides more detail on how these apps were selected.

Adaptations for an alternative school setting. Consideration was given to adapt the program to an alternative school audience. A meal was served before each session to build relationships. Facilitators were encouraged to be flexible, understanding that some changes may be necessary as they got to know participants and group dynamics. We were sensitive that literacy skills may be low, based on discussions with teachers. Fewer written activities were included, and students were provided with options to draw or work with others when handouts were used. The intervention was developed and delivered using a trauma-sensitive lens. The setting was a familiar classroom and a teacher or counsellor known to youth was always present. Safety messages were used to encourage youth to choose how to participate in the session (e.g. how to sit, eyes open or closed), regular reminders that each person's experience with mindfulness is unique were shared, and ground rules were established as a group. Program facilitators and school staff watched for any participants that may have been triggered or overwhelmed. Process evaluation was completed to assess whether using these strategies translated into youth feeling safe during the mindfulness sessions.

1.2 Thesis Overview

This thesis focused on a pilot study for the CRIS-Youth study funded by the Alberta Cancer Prevention Legacy Fund. Ethics approval was obtained from the Health Ethics Research Board of Alberta (HREBA) - Cancer Committee. The pilot study involved 17 youth attending an alternative school in Lethbridge, Alberta. Students participated in an eight session mindfulness program, delivered during class time.

This thesis was written in a traditional format: Chapter 2 is a review of the literature, Chapter 3 describes methods used, Chapter 4 shares results, and Chapter 5 provides discussion and conclusions.

1.2.1 Process evaluation

This thesis aimed to understand the degree to which the mindfulness intervention was delivered as planned (fidelity to both the original program and adaptations) and the experience of youth participating through process evaluation. This provided information on what to continue or improve on for future cohorts of the CRIS-Youth study. My *first research objective* was to examine how the Learning to BREATHE program was adapted: (a) to include technology, and (b) to suit the alternative school audience. My *second research objective* focused on youth engagement, examining youth: (a) attendance and attention at sessions, (b) the effectiveness of facilitators in engaging youth, and (3) levels of home mindfulness practice. My *third research objective* was to understand youth experiences in the program in relation to (a) changes in their understanding of mindfulness, (b) perceptions about the benefits of mindfulness, and (c) overall impressions of the sessions

1.2.2 Outcome evaluation

Outcome evaluation was planned; however was deferred to be included in future studies when data from other cohorts is collected. Future studies will investigate the following questions:

1. Did participation in a mindfulness intervention lead to a reduction in cancer-risk behaviours (smoking and sugar-sweetened beverage consumption)?
2. Was there an increase in emotion regulation among participants?
3. Were observed changes in cancer-risk, emotion regulation, or perceived stress due to changes in mindfulness?

Students were asked a series of questions pre and post intervention to assess for any changes in cancer-risk behaviours, emotion regulation, perceived stress, and mindfulness.

Cancer-risk behaviour. Relevant questions from the 2019 National High School Youth Risk Behaviour Survey (YRBS) on smoking and sugar-sweetened beverage consumption were asked. The YRBS has been used since the 1990s. Though the questionnaires have been slightly adapted through the years, they have provided fairly consistent results since 1991 without drastic changes. On the 1995 YRBS nearly two thirds of the questions had reliability scores between 0.6 and 1.0, though it was noted that administration to students in grade 9 and above was more reliable than with younger students.[58] On the 1999 YRBS survey, overall tobacco use questions had kappas over 0.7, while eating behaviour questions scored lower with some kappas as low as 0.4. Problematic questions have since been changed in the questionnaire, though there have been no further reliability studies.[59] The questionnaire is widely used. The Centers for Disease Control and Prevention recommend that for accurate results, youth must know their participation is anonymous and perceive the questionnaire as being important.[60]

Questions on smoking from the Canadian Student Tobacco, Alcohol and Drugs Survey were also used, as this survey included questions about short-term behaviours as well as smoking intentions.[61] This is a school-based survey delivered across Canada to grade 6-12 students. While it has not gone through vigorous validation it was pilot tested prior to implementation and has since been used with over 100,000 students.

Emotion Regulation. The Difficulties in Emotion Regulation Scale Short Form (DERS-SF)[62] was administered. This tool conceptualizes the construct of emotion dysregulation, which fits within the second level on the ACEs pyramid of social, emotional and cognitive impairment. Some evidence suggests that interventions that successfully enhance emotion regulation skills can decrease the likelihood of adolescents partaking in negative or risky behaviours.[63,64] Learning to regulate emotions can be a tool to allow survivors of childhood trauma to turn off their neurobiological alarm system.[65,66] Some evidence suggests interventions that successfully enhance emotion regulation skills can decrease the likelihood of adolescents partaking in negative or risky behaviours.[63,64] This outcome variable fits within the social, emotional, and cognitive impairment level of the ACE pyramid.

Validation of the original DERS tool completed with 428 high school students gave Cronbach's alpha values ranging from 0.8 to 0.9 for the six subscales of the tool.[67] DERS scores were also found to significantly correlated with anxiety, depression, alcohol use, drug use, eating disorders and suicidal ideations. A short form, DERS-SF, was created to reduce respondent burden, as the original tool has a total of 36 questions within the six subscales which may address similar constructs. The DERS-SF has 18 questions.[62] Validation with 257 adolescents gave a correlation value of 0.98 for total score on the DERS compared to DERS-SF.[62]

Mindfulness. The construct of mindfulness was assessed using the Child and Adolescent Mindfulness Measure (CAMM).[68] In the current literature on adolescent mindfulness, proxy measures such as gratitude or well-being are often used rather than directly measuring mindfulness.[69] Studies that do measure mindfulness often use adult measurements in adolescents, failing to account for development and the uniqueness of the teenage brain.[69] The CAMM assesses three facets of mindfulness: observing internal experiences, acting with awareness, and accepting without judgment. It is a ten-item questionnaire that uses simple language relevant to youth. It has been found to have good internal reliability in a variety of adolescent populations, with Cronbach's alpha scores reported between 0.8 to 0.84.[68,70–72]

Additional questions were asked to see if youth used mindfulness outside of the sessions and how, if at all, they found it to be helpful. Reports of between-session practice can provide information on dose-dependent effects. It is also an indicator of perceived value, since elective application of skills outside of the class would be a strong indicator of perceived usefulness.

Baseline Trauma Symptomology. An adapted version of the SCARED (Screen for Children Anxiety Related Disorders) Traumatic Stress Disorder Scale was administered at baseline data collection.[73] The short survey asks about trauma symptomology rather than what traumatic events youth have experienced, thus decreasing the chance of retraumatizing youth or leading youth to disclose events or harms they may not want to (as researchers will communicate with youth the legal obligations of what disclosures must be followed up on). Muris et al. used the SCARED scale in a sample of 996 children (7-19 years) and reported internal consistency of 0.8.[73]

1.3 Results and Significance of the Research

Cancer, the top cause of mortality in Canada, is linked to several modifiable lifestyle factors.[57] Addressing health-risk behaviours in adolescence can create healthy lifelong habits.[1–4] Cancer-risk behaviours are higher among youth attending alternative high schools, and these unhealthy behaviours may be used to cope with stress.[18,24] There is a call for public health to consider the role stress and trauma play in the development of health-risk behaviours.[21,22] Mindfulness may offer a healthy coping strategy to youth, promoting emotional regulation within the adolescent brain.[39,40]

This thesis provided valuable feedback on an adapted mindfulness intervention for youth attending an alternative school. The process evaluation demonstrated that program adaptation was successful at integrating technology, while maintaining fidelity to the original Learning to BREATHE program. Adaptations to suit an alternative school audience, such as sharing safety messages and establishing mutual ground rules, were implemented. More research is needed to know if these adaptations translated into a better experience for participants. Youth were generally engaged in sessions, though asked more movement be included. Some improvements in facilitation were suggested to enhance engagement. Participant reflections on the mindfulness classes were mostly positive. All youth demonstrated increased understanding of mindfulness and found it to be a tool for relaxation and coping. Some youth identified mindfulness as beneficial to others rather than themselves. Results from this process evaluation will be used to inform the mindfulness intervention for future cohorts of the CRIS-Youth study. Outcome data collected from this pilot study will be used along with data from future cohorts to understand what role mindfulness, a health coping strategy, can play in decreasing engagement in cancer-risk behaviour among youth.

CHAPTER 2: REVIEW OF THE LITERATURE

2.1 Introduction

The main research objectives of this thesis were to understand program adaptation, youth engagement and youth experience through the process evaluation of a mindfulness intervention delivered to junior high students attending an alternative school. This process evaluation was undertaken to ensure a strong mindfulness intervention for the overall CRIS-Youth study which aims to understand the extent to which participation in a mindfulness intervention can lead to decreased engagement in cancer-risk behaviours (smoking and sugar-sweetened beverage consumption) and whether this association is mediated by increased mindfulness and emotional regulation. Thus, this chapter provides a review of the literature in the following areas: (1) cancer-risk behaviours, specifically tobacco and sugar-sweetened beverage consumption; (2) typical approaches used to address cancer-risk behaviours among adolescents and suggestions for novel approaches that consider trauma; (3) the potential role of mindfulness in healing and how it has been used with youth to date; and (4) an overview of Learning to BREATHE*: A Mindfulness Curriculum for Adolescents to Cultivate Emotion Regulation, Attention, and Performance* and why it was chosen to guide the current intervention.

2.2 Cancer-risk Behaviours

2.2.1 Tobacco use and sugar-sweetened beverage consumption

Two common cancer-risk behaviours were the focus of this review – tobacco use and sugar-sweetened beverage consumption. Tobacco use is defined as the recreational and habitual use of any tobacco products through smoke inhalation (such as cigarettes) or smokeless products (such

as chewing tobacco).[74] Sacred and recreational tobacco are very different in how they are used. For many Indigenous people tobacco was and continues to be used for sacred and medicinal purposes, typically with minimal inhalation.[75] Recreational tobacco use is a public health problem. The link between tobacco use and cancer is an established scientific fact recognized in systematic reviews examining several types of cancer (such as lung, colorectal, ovarian and gastric).[25–28]

Sugar-sweetened beverages refer to a broad category of drinks sweetened with added sugars, such as soft drinks, sports drinks, flavoured water, energy drinks, sweetened coffees or teas.[36] The sugary drinks category also includes 100% fruit juice. Neither category includes beverages sweetened artificially, such as diet soft drinks. The World Health Organization recommends limiting these beverages, and that added sugars from all food and beverages consumed make up no more than 10% of an individual's total caloric intake.[76] Consumption of sugar-sweetened beverages has been linked to increased cancer risk.[36] High intake of sugar-sweetened beverages is also a risk for increased body weight and type 2 diabetes, both of which have been causally associated with cancer.[8–10,33–35,77–79]

2.2.2 Prevalence of smoking and sugar-sweetened beverage consumption

Amongst Canadian youth in grades 7-12, 2016-17 estimates suggested the smoking rate (i.e., any use of a tobacco product in the past 30 days) to be 10%.[13] The use of electronic cigarettes and vaping is increasing, with 2018 data suggesting these were used by 37% of Canadian youth aged 16-19 in the past 30 days.[80] Reliable estimates of sugar-sweetened beverage consumption among youth in Canada are dated. Data that is now 15 years old suggests 53% of males and 35% of females aged 14-18 years drank at least one soft drink a day.[81] At that time, sweetened beverages (soft drinks and fruit-flavoured drinks) accounted for 7% of male and 8% of female youth caloric

intake.[81] To understand current beverage consumption trends in Canada, Jones, Lennert Veerman and Hammond undertook a report that examined market trend data between 2001-15.[36] While the overall purchase of soft drinks decreased, this was offset by the increased purchase of sugar-sweetened energy drinks and flavored waters. Average caloric intake from beverages was estimated using market projections. For 14-18-year-olds, 227 kilocalories were estimated to come from sugar-sweetened beverages daily and this increased to 296 kilocalories when fruit juice was included. This reflected 11% and 14% of the average daily energy intake (2,112 kilocalories) estimated for this age group from 2015 Canadian Community Health Survey data.[82] The consumption of sugar-sweetened beverages in Canada is currently above World Health Organization recommendations, with projections suggesting that they are continuing to increase across populations, reinforcing the importance of interventions to address this behaviour, particularly among youth, given excessive sugar intake has toxic effects on health over time.[33,34,36,78]

2.3 Reducing Cancer-risk Behaviour

2.3.1 Adolescence: An opportune time to address cancer-risk behaviours

There is an increase in risk taking behaviours such as smoking, binge drinking, and risky sexual behaviour among adolescents.[83–85] These unhealthy behaviours can become coping strategies for youth experiencing toxic levels of stress in their lives, with psychosocial factors playing a role in the development of risk factors such as early tobacco and alcohol use or early age of sexual activity.[19] The prefrontal cortex of the brain, responsible for executive control functions including emotional regulation and decision making, undergoes significant development during adolescence.[23] Adolescents experience more activation of the nucleus accumbens, the brain region associated with reward and pleasure, than adults when in stressful situations and

especially when surrounded by peers.[23] This may explain high levels of risk taking. Adolescence is an opportune time for prevention efforts to focus, addressing cancer-risk behaviours before they become ingrained.[2]

2.3.2 Typical approaches for preventing cancer-risk behaviours in youth

Despite calls to address cancer risk factors during adolescence, and evidence that such behaviours are often used to manage stress among youth, there are limited examples of interventions aimed at cancer prevention or stress management. Messaging is typically negative, advising youth to avoid certain behaviours rather than promoting positive behaviours.[3] Emphasis is largely placed on education around certain behaviours in isolation, such as smoking or substance-abuse.[3]

A 2014 randomized trial done in Germany provided one example of broad cancer-risk behaviour prevention education.[86] Grade seven students ($N = 235$) were randomized to a school-based cancer education program or wait-list control. The one-week intervention included education sessions on smoking, sun protection, physical activity, nutrition, and alcohol consumption. Results showed that knowledge increased, but there was no effect observed on intention building surrounding health behaviours.

A culturally-adapted cancer risk-education program for Indigenous youth 10-12 years living in the Northeastern United States in 1996 was delivered by Schinke et al.[87] Culturally-relevant curricula were developed by the researchers, and delivered over 15 sessions by Indigenous community members. Sessions included both traditional knowledge and culture, and western cancer prevention education. A total of 86 youth participated with 8 sites randomized to either tobacco education alone, dietary education alone, combined tobacco and dietary education, or control. Self-report measures were collected on knowledge, attitudes and perceived ability to

change. Youth in the nutrition education and combined education intervention groups improved knowledge of healthy foods and reported significant positive changes in diet based on food frequency questionnaires (lower fat and higher complex carbohydrates intake) than youth in the tobacco education only or the control groups. Similar results were observed for tobacco, with improved knowledge and less smoking found in those youth attending either the tobacco alone or combined education groups. The authors suggested value in blending science and culture, recommending the combined tobacco and dietary education approach be used again. This study did not have any long-term follow-up.

A community program in Boston had cancer prevention as the overarching goal of a recreational basketball league for males 14-18 years living in public housing.[88] The intervention promoted physical activity in a fun way and delivered educational workshops weekly on topics such as nutrition or overcoming substance abuse. A feasibility evaluation was undertaken. The authors obtained baseline measures that showed risky behaviours to be prevalent in the population, for example almost half of the youth reported drinking alcohol in the past month. Despite lacking any robust evaluation or statistical analysis, this is another example of cancer-risk behaviour effort going beyond education alone. The three studies summarized above provide examples of the limited interventions to address overall cancer-risk behaviour in youth, however, do not provide strong evidence or direction for future programs. The following section discusses examples in the literature of how smoking and sugar-sweetened beverage consumption in youth have been targeted individually, as there are more examples of interventions addressing each of these specifically.

Typical approaches to tobacco reduction and cessation. There are many examples of interventions focused on tobacco cessation and prevention in the literature. A 2017 Cochrane

review done by Fanshawe et el. focused on tobacco cessation efforts targeted at youth.[89] Forty-one studies were included that used a wide range of interventions such as pharmacotherapy, counseling or group sessions. The authors concluded there was not enough evidence to support any particular method over youth trying to quit on their own.

A meta-analysis of strategies for behavioural interventions preventing smoking in children and adolescents analyzed data from seven randomized control trials and found participants in the intervention groups were 18% less likely to have initiated smoking compared to those in control groups (RR = 0.8, 95% CI = 0.7-0.9) .[90] There was insufficient evidence to conclude which strategies were most effective or features that should be a part of a primary care approach to tobacco prevention. The analysis included a wide range of ages from children to older teens; it may be that the best behaviour change approach is different based on stages of development.

Education alone is an inadequate approach to address smoking. Data from the 1996–1997 Canadian National Population Health Survey found knowledge about the adverse health effects of smoking to be widespread, but having this knowledge did not predict whether adolescents smoked.[91] Stress, peers and addiction all play a role in determining why teens smoke.[30,31] A 2014 systematic review of barriers to smoking cessation in vulnerable populations found use of smoking as a stress management technique and lack of support to be significant barriers to quitting smoking.[92] Indigenous people also cited barriers linked to historical traumas of colonization. The connection of tobacco to culture was also identified, with the authors suggesting that smoking cessation could exclude a person from fully participating in cultural activities or alter relationships.

Summary of typical approaches for tobacco reduction and cessation. Typical approaches to tobacco reduction and cessation focus on education. Which particular strategies are most

effective for tobacco cessation and prevention with youth is not clear. Long-term follow-up is often lacking or fails to maintain positive results.

Typical approaches to address sugar-sweetened beverage consumption. There are many examples in the literature of efforts to address sugar-sweetened beverage consumption in youth, especially in school settings. In 2018 Rahman et al. completed a systematic review and meta-analysis of behavioural interventions to decrease children and adolescents' consumption of sugar-sweetened beverages.[93] Only four of the 16 interventions took place out of school settings, with two of these showing a reduction in sugar-sweetened beverage intake and two showing no effect. The overall age of participants was low. Some studies captured early teenage years in their population, but none included later adolescence. Three of the included trials had data that could be combined for meta-analysis: one at home intervention (provided milk and education to families) and two at-school interventions (promoted water). No significant decrease in sugar-sweetened beverages was observed. Mediators of change were not investigated thoroughly, so it was not possible for authors to evaluate what best predicted a change in beverage consumption behaviour.

A 2017 systematic review of school-based interventions aiming to decrease sugar-sweetened beverage consumption found the majority of interventions to be effective at reducing sugar-sweetened beverage consumption, though overall quality of the studies was weak.[94] Randomized control trials accounted for one third of the included studies. Of the educational or behavioural studies included, only four of the 36 studies included (11%) had a control group. In over half of the included studies, sugar-sweetened beverage consumption was targeted as part of a broad focus on healthy eating and physical activity. Data was most commonly collected by survey or questionnaire, 24-hour recalls, or food records. Most of the educational studies used multiple

behaviour change techniques so authors were unable to identify which were most effective. The techniques most used were providing information about health consequences, goal setting, self-monitoring, and providing social support. The authors suggested that education on health risks is often a first step in behaviour change, however it is not enough to cause change. Another suggestion provided was that future studies look beyond soft drinks alone.

A 2016 systematic review by Racey et al. included 105 school-based interventions designed to change dietary behaviours.[95] No significant difference between the intensity of an intervention (duration, frequency, personalization) and its effectiveness were found. It was typical for longer studies to have less frequent interaction with the population, so researchers suggested this may have led to less reinforcement of behaviours. A loss of effectiveness at mid and long-term follow-ups was noted in the 21 studies that did complete follow-up, suggesting maintenance strategies need to be explored.

Summary of typical approaches to address sugar-sweetened beverage consumption. Interventions aiming to reduce sugar-sweetened beverage consumption focus on providing education on sugar, promoting water, or including beverages as part of addressing overall healthy eating. Systematic reviews and meta-analysis suggest interventions do reduce consumption of sugar-sweetened beverages; however studies are generally of low quality, largely completed in school settings, and focus on younger youth.

2.3.3 Moving to novel approaches for preventing cancer-risk behaviour

Limitations of typical approaches. My review of the evidence suggested there is a need to look beyond education to address the underlying determinants of youth cancer-risk behaviour, including considering the role trauma and stress may play. There is also a call in the literature to de-silo cancer risks, addressing multiple health behaviours together in interventions,

given health risk behaviours tend to cluster and these should be targeted together rather than in isolation.[3,4,96]

Childhood trauma and cancer risk. Current health interventions often attempt to have individuals move from an immediate coping solution, such as smoking, to one that is motivated by long-term health benefits.[21] These approaches fail to consider the nuances behind health-risk behaviours, which may be rooted in experiencing psychological trauma in childhood. Experiences such as abuse, neglect, loss of a loved one, or poverty can cause toxic stress when experienced chronically.[20] Toxic stress is described as repeated, strong or prolonged exposure to stress without the protection of a supportive adult relationship.[97] The body in a chronically stressed state fails to return to homeostasis, instead experiencing a prolonged stress response which leads to dysregulation of hormones and neurotransmitters.[98] Brain architecture can especially be affected at sensitive times in development (prenatal, infancy, early childhood) and particularly if a child lacks a supportive adult in their life.[97] Childhood traumas or ACEs can lead to social, emotional and cognitive impairment which can lead to the adoption of health-risk behaviours as coping mechanisms.[21] These health-risk behaviours increase risk for a variety of diseases which can lead to early death.

There is strong evidence linking childhood trauma to several types of cancer. The original ACEs study collected information on almost 10,000 patients in 1995 and 1996 as a prospective cohort study.[21] An increasing ACE score was found to be related to risk of cancer, reaching significance when participants experienced four or more ACEs (adjusted OR = 1.9, 95% CI = 1.3-2.7).[21] Data from the original ACEs study showed the risk of lung cancer was three times higher in people with an ACE score of six or more, versus those people with no ACEs.[99] In 2010, the American Behavioural Risk Factor Surveillance System survey results were used to look at cancer

diagnosis in relation to ACEs, specifically the results from Wisconsin as they opted to include questions on both ACEs and cancer.[16] A total of 4,230 respondents were included, with over 60% reporting at least one ACE on an adapted telephone survey. The traumatic impacts of sexual assault were associated with the diagnosis of cancer in adulthood (OR = 1.2, 95% CI = 1.0-1.4), after adjustment for a variety of factors such as age or ethnicity. Findings from the 1958 British birth cohort study, published in 2013, found a significant increase in cancer when women had experienced trauma. Women with greater than two ACEs had twice as great a chance of having cancer before age 50 versus women with no ACEs.[14] Cancer-risk behaviours, including smoking and carrying excess body weight, have also been linked to trauma.[14–18]

Tobacco use and childhood trauma. Tobacco use is higher in adults who have experienced childhood trauma.[22] In 2017 Hughes et al. conducted an international systematic review and meta-analysis that captured 37 studies (N = 353,719) , with all but 11 using randomization or whole population approaches.[22] All of the studies collected retrospective, self-reported ACE scores. Meta-analysis was completed with studies presenting risk estimates for participants with four or more ACEs versus none. The odds of smoking were more than double in the group that reported four or more ACEs (OR = 2.8, 95% CI = 2.4-3.3). Higher ACE scores were also associated with ever smoking and an earlier age of smoking initiation.[1,99,100] Similar results were found in youth when Siqueira et al. surveyed nearly 1,000 inner-city youth in New York.[18] Perceived stress and negative life events were reported significantly more in smokers versus non-smokers. The risk of being a smoker increased significantly when youth had experienced more negative events in their life. When current smokers were asked what caused them to transition from occasional use to consistent use, stress was the top answer. In both adults and youth, the stress of childhood trauma is linked to smoking.

Overweight status and childhood trauma. There is limited literature looking specifically at sugar-sweetened beverages and trauma, however evidence does support a link between excess body weight and childhood trauma. A cross-sectional study with over 3,000 women in Texas suggested the presence of PTSD symptoms was associated with an increased risk of drinking more than one pop a day (OR = 1.1, 95% CI of 1.0-1.1).[101] The 2017 systemic review completed by Hughes et al. included eight studies which investigated the relationship between ACEs and weight.[22] The odds of living with overweight or obesity, based on BMI, were higher for participants with four or more ACEs compared to those participants with no ACEs (OR = 1.4, 95% CI = 1.1-1.7). Similar results were found in a 2014 meta-analysis performed by Danese et al. that included over 190,000 participants.[102] Childhood trauma was linked to an increased risk of developing obesity over the life-course (OR = 1.4, 95% CI = 1.3-1.5). A link between obesity and trauma was also found in a 2016 systematic review examining childhood trauma, obesity and binge eating behaviours.[103] Of the 70 studies included, 85% reported statistically significant associations between obesity and at least one type of trauma. Associations between PTSD symptomology and obesity, assessed by waist circumference or BMI, were also observed in 86% of the included studies. The authors discussed factors that might explain these relationships. Elevated cortisol may cause stress-induced eating. PTSD symptoms, such as dissociation or disconnecting from emotions, can push an individual away from self-awareness and inhibitions which are both linked to binge eating. Emotions linked to trauma such as anger, depression, or stress could all play a role in the pathway linking trauma to increased body weight.

There are limited examples of interventions addressing the link between childhood trauma and excess bodyweight. In 2018 McDonnell et al. did a systematic review searching for group

interventions addressing weight among women with a history of childhood trauma and obesity, however found no studies to include.[104]

It is novel to examine the link between sugar-sweetened beverage consumption and childhood trauma, stepping into an area where more research is needed but one that does make physiological sense. Elevated cortisol levels in the body, as in the case of chronic stress, increase preference for sugar.[38] Decreasing sugar-sweetened beverage intake can decrease obesity and subsequent related diseases, like cancer.[77] The link between childhood trauma and overweight or obesity status is established, however there is a lack of interventions that aim to address this connection.

Trauma amongst Indigenous Canadians. The perpetuating effects of colonization represent a common experience for the many Indigenous groups in Canada, leading to inexcusable health and social suffering.[105,106] The effects of this trauma should be considered in any intervention with Indigenous people. Chronic stress and unresolved grief from colonization reverberate through generations.[107] The collective trauma of children being taken from their families during residential schools and the Sixties Scoop led to a loss of parenting skills, and depleted traditional languages and knowledge.[106,108,109] In Canada over 150,000 Indigenous children were sent to residential schools between 1870 and 1996 with the goal of assimilation.[110] As highlighted by the Truth and Reconciliation Commission, child sexual abuse, physical abuse, emotional abuse, and neglect were common experiences in residential schools.[111] Child neglect was institutionalized, with harsh discipline and unreported abuse rampant.[111] The Sixties Scoop was a national child welfare policy that had thousands of children removed from their families and communities from the 1960s onward.[111] Indigenous youth are alarmingly over-represented in the child welfare system today, and they are taken into care at a rate eight times higher than the

national average.[109] According to 2016 Canadian Census data, 52% of children in foster care are Indigenous while only 8% of children in Canada are Indigenous.[112]

Summary of childhood trauma and cancer-risk behaviours. In summary, there is robust evidence linking childhood trauma to later health risks, including cancer. A strong linkage has been established between trauma and smoking, supported by a large systematic review and meta-analysis. Examining the linkage between sugar-sweetened beverages and trauma is novel.

2.4 The Potential Role of Mindfulness

There is a call for public health to consider ACE-informed approaches and resilience building in people who have experienced trauma.[22] Mindfulness may be a way to reduce cancer-risk behaviours among youth, addressing stress that often underlies these behaviours. Mindfulness is cultivated through paying attention in a specific way and bringing non-judgemental awareness to the present moment.[41] Both trauma and mindfulness have impacts on brain structure and functioning; understanding the overlap explains potential mechanisms of how mindfulness may play a role in healing from trauma. The next section explores how both trauma and mindfulness may affect the brain.

2.4.1 The brain-body connection

Impacts of trauma on the brain and body. Toxic stress in childhood can disrupt brain development and lead to changes in behaviours or ability to cope when faced with further adversity.[97,113] Clinical differences and subsequent behavioural changes have been observed in the brains of children who experienced trauma.[15,98] The neuronal structure and connectivity of the amygdala, prefrontal cortex and hippocampus can be especially altered.[15,97,98] When the body's stress response is activated a cascade of neurotransmissions is initiated, increasing

cortisol concentrations.[98] Significant stress in childhood can cause hypertrophy of the amygdala, resulting in a chronically activated stress response.[97,98] This may appear as hypervigilance, fear and anxious behaviours.[97,98] Chronic stress and the exposure to elevated levels of cortisol can change the prefrontal cortex, affecting executive functions such as impulse control and problem solving.[98] An individual is therefore moved from rational thinking to survival mode where they are on high alert.[114] Memory impairment, changes in mood and a diminished ability to distinguish between safety and danger can occur due to changes in the hippocampus.[97] The prefrontal cortex and hippocampus both help modulate the amygdala activity and regulate the body's stress response, however in a state of chronic stress this ability is diminished.[97] Overall, youth exposed to chronic stress are likely to be in an anxious and overly reactive state.[15,97,98]

Potential effects of mindfulness on the brain and behaviour. In contrast to the ruminant and anxious tendencies of chronic stress, mindfulness focuses on bringing attention to the present moment. Emerging research suggests mindfulness impacts the brain and behaviours associated with emotion, attention and self-awareness.[115,116]

Research on mindfulness altering specific brain regions has focused on adults. In a 2018 systematic review, Young et al. investigated impacts of mindfulness on brain activity assessed by magnetic resonance imaging.[116] Seven longitudinal studies were included that used within-subject scans before and after participation in a mindfulness intervention. Results focused on brain regions associated with cognitive processes: the insula, the anterior cingulate cortex (ACC) and the prefrontal cortex. A popular idea of how mindfulness may affect the brain is through strengthened cognitive control which downregulates the amygdala and the body's stress response. Four of the included studies reported increased activity in the insula post-intervention. The insula is involved in self-awareness, so the authors speculated this increase was due to

present-moment awareness of mindfulness. The increased insula activity was not noted in studies including individuals with clinical symptoms of social anxiety or bipolar disorder, nor in a group of Marines where the intervention focused more on acceptance rather than awareness. Two of the studies in this linked the increased insula activity with improved self-reported resilience and emotion identification. Many mindfulness studies have discussed the benefits of emotional regulation, suggesting the non-judgmental focus of mindfulness affects the ACC. Only two studies in this review noted increases in ACC activity. Three studies saw changes in regions of the prefrontal cortex. The prefrontal cortex is thought to be involved in awareness of thoughts and acceptance in mindfulness. The authors noted that altered activity in the prefrontal cortex has been reported previously in less rigorous reviews or studies, however this review failed to find strong evidence of these changes across included studies.

Tang, Holzel and Posner provided a 2015 narrative review to explain the neuroscience of mindfulness.[115] They suggested the amount of mindfulness experience someone has might explain differences in brain effects.[115] Early mindfulness practice involves overcoming the habit of internally reacting to emotions, where there is a need to exert purposeful control and mental effort. Experienced mindfulness practitioners have likely moved to a more automated process of greater acceptance and exerting less control. More activation in the ACC and less activation of the amygdala may be observed in early stages of mindfulness. A similar effect modification due to experience was noted in a 2011 systematic review of the neurophysiological impacts of meditation in adults. Chiesa, Calati and Serreti found that level of experience affected a variety of measures of attention, memory and executive functions.[117] They discussed how early meditation focuses on redirection to the present and selective inhibition of thinking. In later stages of meditation noticing distraction happens sooner, so people are more alert to the present.

There have been no systematic reviews of mindfulness neuroscience in youth. In 2015 Sanger and Dorjee shared perspective on neurodevelopment in youth and directions for future studies to take, focusing on awareness and emotion regulation.[118] The authors suggested it was plausible that ACC research could transfer to youth, where mindfulness encourages prefrontal connections that stabilize the arousal response and possibly reduce risk-taking behaviours. They speculated that attention markers are likely similar to those of adults, just lower at baseline as youth are known to have higher risk-taking tendencies. There is a need for more research in this area specific to youth. Even in adults, while the research on how mindfulness affects brain structure and function is growing, there are still limitations. Reviews are often broad; there is much variation in studies with population assessed, type of mindfulness or meditation practiced, or tests delivered to participants during scans.[116] The use of resting state comparisons is common, however an experienced practitioner may enter into mindfulness when at rest.[115] There are few studies that relate understanding of what is found in brain scans with self-reported measures, so it is difficult to fully interpret effects on behaviour.[115]

Potential links between mindfulness and trauma in the brain. There is limited research connecting changes in the brain from mindfulness to the effects of trauma, however a few potential mechanisms are suggested. In a 2018 systematic review, Young et al. pointed to the role mindfulness might play in rumination, describing improvements in insula activity in a group with general anxiety.[116] Rumination, a typical symptom of trauma, might be helped through increased present-moment focus. A 2018 scoping review investigated hypothesized mechanisms for how mindfulness training addresses PTSD symptoms.[119] Avoidance symptoms may be addressed through a focus on openness to experience, alterations in mood and cognition through non-judgmental acceptance practices, and reactivity lowered through remaining in the present

moment. Symptoms of dissociation may also be addressed through mindfulness, but the mechanism of how requires more research. Stress reduction might also explain the connection between mindfulness and changes in the brain. Tang, Holzel and Posner suggested this could happen potentially through two ways: improved self-regulation enhancing neuroplasticity in regions sensitive to stress or through reduction of an overactive fight or flight response.[115]

There is limited research on mindfulness, trauma and brain connections in youth. In a 2017 review, Ortiz and Sibinga discussed ways mindfulness might benefit individuals exposed to ACEs by decreasing the immediate responses to stress and influencing long term consequences of chronic stress such as unhealthy lifestyle choices, neurobiology and disease.[39] Mindfulness may also help with dissociation after experiencing trauma, thus increasing resiliency.

Summary of effects trauma and mindfulness may have on the brain. Chronic stress may alter the brain, leading to a state of hypervigilance and a decreased ability to regulate the body's stress response. Mindfulness may act on the brain to strengthen cognitive control, self-awareness and emotional regulation. The investigation of how mindfulness affects the brain is still in early stages and has centred on adults; strong youth-specific research is extremely limited.

2.4.2 Youth mindfulness interventions

Mindfulness-based interventions for youth have been gaining in popularity. A 2015 search for mindfulness interventions on PsychInfo found 8% of the 3,350 studies focused on youth, the majority of which (79%) were published after 2010.[42] The Mindfulness Based Stress Reduction (MBSR) course originally developed by Kabat-Zinn consists of eight meetings plus a full day of mindfulness practice and uses experiential meditation exercises to help cultivate a day-to-day practice. There have been many MBSR adaptions developed and a wide range of programs implement principles of mindfulness, sharing the commonality that they all aim to cultivate

concentration and attention in some way.[45] Mindfulness interventions for youth must consider the uniqueness of developmental stages, where lengthy meditation practices may be unsuitable. Practice time is suggested to be between five to 15 minutes in contrast to a traditional 40 minute length for adults, or equaling minutes of practice time to the age of participants.[120,121] Interventions delivered to youth vary greatly and include many adaptations of MBSR.

Much of the research to date on youth mindfulness has focused on school settings. A 2016 systematic review by Felver et al. included 28 studies focused on mindfulness-based interventions for youth in school settings, capturing a total of 3,414 participants.[43] While studies varied on how much intervention detail was provided, it was clear that most (n = 25) used group mindfulness interventions, with the average group size being 16 students. Experimental designs were used in a third of the studies, and only 11% used a well-matched control. Findings suggested school-based mindfulness interventions had positive impacts on psychosocial outcomes such as anxiety, depression, and suicidal ideations. Outcomes were discussed broadly, with no discussion of whether the results reached significance. School-based mindfulness programs were again examined in a 2019 systematic review by McKeering and Hwang.[122] Thirteen studies (7 quantitative, 6 mixed methods) focused on ages 11-14 years were included, capturing a total of 2,277 youth. Analyzing the quality of included studies was a focus of the review, and the authors found much variation. Key areas identified as lacking strong rigour were: only four of the studies included an active control group, four studies used non-randomized methods, three studies reported validity measures for outcome used, and three studies reported fidelity. Eleven of the studies reported improvements in self-reported measure of well-being such as positivity, social functioning, and coping. Physical improvements in heart rate and blood pressure were reported. Studies that included qualitative components reported themes of students

participating in mindfulness and perceiving benefits in coping and emotion control. Eleven of the studies provided details on the mindfulness intervention used, though there was great variability in the structure and length. There was also variety in outcomes measured.

Semple, Droutman and Reid acknowledged the scarcity of research on youth mindfulness programs, providing a commentary on eight programs without robust evidence in their 2017 review.[45] The authors suggested that while there was great variation in the programs in term of content and delivery, all aimed to build attention and concentration. Zoogman et al. completed a meta-analysis of 20 youth mindfulness interventions between 2004-2011.[123] Improvements in a variety of self-reported outcome measures were significantly larger in participants completing a mindfulness intervention compared to active controls. No significant effect modifiers were found, such as experience of teachers or home practice. This was described as a surprising result compared to research done in adults. The authors speculated around differences with youth such as being quicker to learn so needing less practice. Limited evidence is available to provide direction on which specific components of mindfulness interventions are most effective or to make strong claims about short or long term effectiveness; however, there is much circumstantial evidence that programs are feasible to implement and generally accepted.[44,45,123]

Mindfulness interventions with at-risk youth. As the popularity of mindfulness grows interventions are including more diverse populations, as discussed in the following section. This includes youth with a history of trauma, living in foster care, facing homelessness or incarceration, or recovering from addictions.

A 2017 scoping review by Ortiz et al. on the role of meditation, yoga and tai chi on resilience among maltreated youth included studies looked at effects of mindfulness on emotional well-being, depression, hopelessness and stress.[39] There were six studies included in the review that

targeted or included teens. All used some adaptation of MBSR, though varying degrees of detail on the intervention were included. The interventions targeting teenage youth varied in length from eight to 12 sessions, with session length ranging from 50 minutes to two hours. Nearly all were facilitated by an instructor trained in MBSR, with only one delivered by a psychologist with personal mindfulness experience. Important facilitator traits were discussed, such as experience working with youth and personal mindfulness practice, that might affect the results of an intervention. The authors commented results were promising but did not discuss which areas saw significant results.

One of the interventions included in the Ortiz et al. review was a mindfulness program delivered to 42 youth in foster care for stress reduction.[46] The program was delivered as a randomized control trial, with an intervention group and a wait-list control. The two-hour program was held once a week for 10 weeks. The first hour was spent on a mindfulness curriculum delivered by a psychologist and the second hour was more informal with dinner, speakers, arts, yoga, and time to socialize. Positive improvements in self-reported questionnaires on anxiety, mindfulness and overall well-being were found mainly in youth ages 14-17 years, but not in youth ages 17-21 years. The authors suggested the formative years of younger adolescence as a critical transition point; older youth may have already developed their own coping strategies, whether healthy or risky. In another intervention for youth involved in foster care, cognitive-based compassion training was delivered to 71 participants ages 13-17 years.[47] The sessions involved meditation practices and discussions. A short meditation started the sessions and a longer meditation concluded the sessions; this was done instead of one 20-minute meditation, which the authors thought would be too much for the adolescent population. No difference was observed in depression or anxiety symptoms in the intervention group versus a wait-list control group. No

significant changes were found between pre and post salivary C-reactive protein levels in the two groups; however, within the intervention group, amount of practice time correlated with decreased C-reactive protein levels.

A meditation initiative was delivered to middle school youth, including a group that was facing current or recent homelessness, with a large percentage of the overall study population identifying as belonging to an ethnic minority group.[124] Three groups of students participated in the intervention: youth experiencing homelessness (n = 15), students from a traditional schools setting (n = 28), and a wait-list control group (n = 20). The youth experiencing homelessness reported using the mindfulness skills more often in their daily lives and valuing the skills more than the other treatment group. No significant differences in standardized measures were observed between the two treatment groups.

At an alternative school, Wisner and Starzec integrated mindfulness into grade 10 classes for seven months.[125] A variety of mindfulness practices and approaches are mentioned being used, but no formal program. Each class included instruction on and practice of mindfulness skills, followed by group discussion and input for the next class. Qualitative analyses suggested youth found the classes to improve their self-awareness and self-regulation.

The role of mindfulness in healing from substance abuse has also been studied. In a 2015 chart review of 18-25-year-olds admitted to a substance abuse recovery facility (N = 148), measures of mindfulness were compared to panic and anxiety symptoms.[126] Higher levels of moment-to-moment mindful attention were found to be associated with reduced symptoms of panic and anxiety. Positive results were also found when mindfulness was included in substance abuse treatment in a randomized control trial with 35 incarcerated youth.[50] All youth received standard group psychotherapy and substance abuse treatment, and the experimental group received

mindfulness training. After 12 sessions, the experimental group had significantly higher self-esteem and improved decision-making abilities. Another mindfulness intervention for incarcerated youth used internet-delivery as a way to build coping skills youth could continue to use, as many were returning to dysfunctional families or social situations.[127] A total of 60 incarcerated males, ages 16-22 years, were randomized to a mindfulness meditation group or a guided relaxation group for eight weeks. No significant differences were found in measures of mindfulness (using the Five-Facet Mindfulness Questionnaire), though the authors did discuss whether other measures might have been more appropriate for an incarcerated population. Personal journals used to qualitatively explore treatment experiences suggested that participants in the mindfulness meditation group found it to be more valuable. Forty percent of participants in the mindfulness group wrote at least one journal entry about how they used skills from sessions to deal with conflict, compared to 5% of the youth in the guided relaxation group. The authors hypothesized this may have been related to the active shifts in cognition and emotion during mindfulness, versus the passive process of guided relaxation.

Focus groups with youth who had experienced previous traumas, revealed increased self-compassion was associated with self-acceptance, positive relationships with others, and improved emotional-regulation.[128] The authors suggested improved acceptance of self can lead to a desire for self-improvement, including avoiding destructive activities such as drug use or maintaining healthier boundaries in relationships. Fostering self-compassion can provide youth with healthy coping tools they can rely on in stressful circumstances.[128]

Summary of mindfulness for at-risk youth. In summary, there have been no robust reviews examining the use of mindfulness for at-risk youth. Several small-scale interventions have been done with groups of youth facing adverse circumstances such as substance abuse, incarceration,

homelessness or involvement in the foster system. Positive improvements after participating in a mindfulness intervention were reported on self-esteem and decision-making. Anxiety and mindfulness measures improved in some studies, whereas others saw no significant differences. Some studies failed to report any significant quantitative improvements, however youth qualitatively shared finding value in the programming.

Mindfulness for Indigenous youth. Mindfulness has been proposed as a mechanism to facilitate healing from post-colonial trauma and stress. Yellow Bird described this as happening through a process of neurodecolonization, first learning to understand how the mind functions as a result of colonization-related stresses and then deactivating ineffective brain patterns that lead to negative behaviours.[40] He suggests youth do not fully understand the structural oppression colonization caused or stressors such as racism, loss of territory and poverty. Individuals blame themselves for negative behaviours and negate the role trauma plays. Neuro-decolonization conceptualizes the idea that resisting continual negativity from colonization and promoting traditional practices in the present can replace negative patterns with healthy ones. Minds can be called upon to learn something new, such as using an app for meditation, and something old, such as empowering words from an Elder.[40] Yellow Bird suggests the power of emotions, thoughts and words has been known in Indigenous cultures for a long time but many mindfulness practices were destroyed through colonization. Contemplative practices such as ceremony, meditation and yoga are key pieces of neurodecolonization. Yellow Bird suggests these as an antidote to the Western world tendency of mindlessness, fostering a state of wakefulness. Both Indigenous worldviews and Buddhist philosophies recognize the interconnectivity of all things and an interest in holistic well-being.

In 2009, Yellow Bird facilitated a mindfulness program at a high school with a majority Native American population.[40] Participants had experienced stressful circumstances such as living in foster care or stressful homes, homelessness or on probation. Yellow Bird led sessions and trained teachers to lead sessions on mindfulness for youth. Interviews and qualitative analysis were completed with ten students, who shared how mindfulness allowed them to be truly present and appreciate the sacredness of cultural teaching and activities. The students found parallels between traditional teachings and mindfulness, such as emphasis on gratitude and awareness of connections among living things. While this study was qualitative and had a small population, it did provide insight into the potential role of mindfulness in healing and how it can resonate with Indigenous youth.

Another school-based intervention was offered to Native American students by Le and Gobert in 2015.[129] Eight students in grades 7-12 participated in an elective class on mindfulness for suicide prevention. The class was nine weeks long and used a culturally adapted version of the program Mind Body Awareness.[129,130] The adaptation process involved meeting with opinion leaders, Elders and practitioners in the community to include traditional language and mindfulness practices, as well as decide on who in the community could facilitate. The intervention was delivered with everyone sitting in a circle and agreeing on guidelines for creating a safe space together. The authors noted having a safety protocol in place if any student had an adverse reaction, however this did not need to be used. Evaluation largely focused on feasibility. Overall acceptability of the program was high. Pre and post survey comparisons suggested improvements in suicidal ideations and impulsivity, though the population was very small.

The adapted mindfulness curriculum was used again by Le and Proulx in 2015, with additional Indigenous language included. Thirty-four incarcerated Indigenous youth participated in a five-

week, twice weekly intervention.[48] Self-reported measures and saliva samples were collected pre and post intervention. Significant improvements were observed in perceived stress, and in levels of cortisol and Salivary Secretory Immunoglobulin A (SIgA), markers of stress, in saliva. Changes in mindfulness, self-regulation and impulsivity were non-significant. The sample size was small and there was missing data (11 missed cortisol and seven missed SIgA), however these results are still interesting given the overall lack of biomarker data use in assessing mindfulness interventions. Qualitative analysis of journals showed youth were experiencing more positive emotions, not identifying with emotions, and connecting with their culture's values and language.

In 2015 Dreger, Mackenzie and McLeod offered mindfulness as a tool for the management of type 2 diabetes with Indigenous adults living in Manitoba ($N = 11$).[131] The eight week program was offered in one rural and two urban settings. The MBSR program was adapted to include increased storytelling and a mindfulness meditation medicine wheel. The authors suggested pieces of MBSR already fit within an Indigenous worldview, such as the emphasis on sharing stories and experiences or sitting in a circle. The program did not include explicit spiritual teachings, acknowledging that traditions and practices vary according to specific cultural groups and individuals. A local Indigenous Elder was trained in MBSR and co-facilitated. Significant improvements were observed in blood glucose, blood pressure and self-reported measures of general well-being. Measures of depression and anxiety did not change significantly. Overall the program was well accepted, and participants thought it should continue in their communities.

Summary of mindfulness for Indigenous teens. There are many parallels between traditional Indigenous practices and mindfulness. Interventions can be adapted to include more local language, storytelling and traditional practices. Research investigating mindfulness interventions

for Indigenous youth is limited, with only small sized studies available to review. Whether improvements were seen on standardized measures varied; however, there was commonality in that youth found value in mindfulness programming.

Trauma-informed mindfulness interventions. Mindfulness training has proven to be beneficial for a wide range of people, including those who have experienced trauma. In populations with a likelihood of high ACEs, mindfulness can be primary prevention so all have the opportunity to gain resiliency and coping skills.[39] Whether trauma is reported or not, mindfulness can still be beneficial, however trauma-awareness is important.[39] Abuse and trauma are often poorly recalled, or youth may not identify certain experiences as such.[132] Realizing high rates of exposure to trauma and stress in a disadvantaged community, a mindfulness intervention delivered to middle school students used a universal trauma-informed approach and the authors reported benefits regardless of symptomology.[133]

It may be foreign for youth to be in the present moment inner experience. Each individual has an optimal zone to experience activities in, such as mindfulness.[134] Siegel describes this as a "window of tolerance" where someone is neither under or over stimulated.[134] Teachers using mindfulness should be adept at recognizing signs a youth has become overwhelmed by traumatic memories, so they can redirect attention away from the inner experience and back to the outer environment if needed.[124] Several studies working with traumatized populations did not offer details about how the intervention was specifically adapted to become trauma-informed.

The Substance Abuse and Mental Health Services Administration (SAMHSA) compiled a list of traits that trauma-informed programs should adhere to: safety, trustworthiness and transparency, peer support, collaboration and mutuality, empowerment and choice, and cultural and historical competency.[135] Ortiz suggested that mindfulness instructor training does incorporate these

elements, creating a foundation for mindfulness as a trauma-informed practice.[39] Distributing journals at the beginning of class can provide an outlet for youth to express any feelings that might come up while exploring mindfulness or if they find themselves having a difficult time sitting still.[127]

There is a lack of research on trauma awareness in youth. Some studies have asked about ACEs, but it is novel to discuss with youth how chronic toxic stress might affect their daily lives. In focus groups with 39 court-involved females aged 13-18 years, participants were asked about behaviours observed in themselves or in others and the perceived causes for these.[136] Themes of angry and aggressive behaviours emerged, with students reporting these coming from the influence of people in their environment or triggers from previous trauma and stress exposure. One reason youth may not keep up a mindfulness practice is not believing that a change in thinking can actually result in any physical changes.[137] Including trauma education with mindfulness may help to addresses this; when youth feel and understand what is going on in their body, they may make the choice to explore mindfulness as a healthy way to cope with this.

Facilitation of mindfulness interventions. There is much variation in the literature regarding who delivers mindfulness interventions to youth, ranging from classroom teachers provided with some training or resources to community members to highly experienced mindfulness facilitators. There is a need for future research to explore the amount of experience or training required to successfully implement mindfulness programs for youth.[43] It is also important to consider the practicalities surrounding bringing in a mindfulness facilitator; it may not be feasible for rural locations or organizations facing financial barriers to bringing in a trained facilitator.[118]

In adapting a mindfulness curriculum for Indigenous youth, Le and Gobert found that no one in the community had formal mindfulness training however many people were engaging in mindfulness practices such as meditation, sweat lodges, or leading cultural camps.[129] These spiritual people became facilitators and were offered training in mindfulness as well as debriefing throughout the intervention with a teacher. A safety protocol was put in place to detail the steps facilitators would take if any youth had an adverse reaction or if they worried about the well-being of any youth. While formal mindfulness programs may be new to communities, these types of practices are deeply rooted in Indigenous cultures and ways of life.

Local facilitators were used again when a similar mindfulness curriculum was delivered to incarcerated Indigenous youth.[48] Facilitators had varying ranges of their own informal mindfulness practices rooted in local Indigenous practices, plus received two days of training and coaching throughout. In working with the incarcerated youth, creating safety and trust was a key responsibility of the facilitators before the intervention could be delivered. The authors highlighted that facilitators should be authentic, open-hearted and willing to share in the process along with the youth.

In her manual – Learning to BREATHE: *A Mindfulness Curriculum for Adolescents to Cultivate Emotion Regulation, Attention, and Performance* – Broderick offers suggestions for traits of a facilitator, stating her intention is not to restrict delivery to only certain professionals but to focus on certain prerequisites that are important for successful implementation.[52] She recommends facilitators should have mindfulness training, ideally in MBSR or engagement in other contemplative disciplines, and maintain their own regular personal practice. Individuals should also have appropriate training to work with youth, as the program requires experience with group

facilitation and understanding youth development. Facilitators may also benefit from seeking out personal supervision or coaching.

Mindfulness and technology. As the popularity of mindfulness increases, a tension exists between increased demand and a limited supply of quality mindfulness facilitators.[138] Using technology to deliver mindfulness offers a cost-effective and flexible way to bring mindfulness training to participants.[138] Technology is playing an ever larger role in adolescents' lives and many youth have mobile devices.[139] Technology offers opportunity for practicing mindfulness skills during daily life.[137] This was the rationale used in delivering a web-based mindfulness intervention for incarcerated youth.[127]

Health-related apps and technology are becoming increasingly available and offer potential for increased scope and accessibility of mental health promotion.[140–142] The retention rates in behaviour change interventions may be improved by using mobile technology.[143] The acceptability of health-related apps in youth has not been studied on a large scale, however adult surveys show high interest in using apps related to mental health.[143,144] Apps provide confidentiality and autonomy, traits that are especially desired by youth.[140,145–147]

A 2016 review by Fish, Brimson and Lynch of technology-based mindfulness delivered to adults suggested this is feasible and effective.[138] Ten studies were included with much variation, though the majority used web-based platforms. Of the five studies that assessed mindfulness, all found positive effects. Changes in depression, anxiety and stress levels appeared similar to those observed in face-to-face interventions and lasted into follow-up when measured. The length of mindfulness practices ranged greatly, though in general the amount of practice time was less than in face-to-face MBSR. No studies monitored the amount of time spent in home practice. The one qualitative study included in the review found participants felt a half an hour time commitment

to be too much.[138,148] Fish, Brimson and Lynch suggested looking at breaking up mindfulness activities into shorter sessions throughout the day or doing a gradual increase.[138] They also suggested novel approaches should be investigated such as integrating technology and face-to-face programs or including varying degrees of facilitator involvement. While including a facilitator diminishes some of the scalability of an intervention with no facilitator involvement, it is important to find balance between efficacy and scalability. Teenagers often don't practice mindfulness skills to the optimal level for therapeutic benefit, and boredom may be a reason for youth not keeping up a practice.[137] In 2015, Evans-Chase delivered mindfulness to 60 incarcerated youth via eight weeks of audio downloads.[127] While it was found that many youth did incorporate mindfulness practices into their lives, a primary complaint was that youth found it boring. Youth crave excitement and interaction; the inclusion of game-like components can have a naturally motivating appeal.[149] It may help to uses the same principles game designers do to engage youth and build intrinsic motivation (curiosity, fantasy, challenge, and a sense of expertise).[137] How users interact with an app can help with motivation, for example gamification with earning points.[140]

A 2016 feasibility study was done using an iPhone app with 16 teens 13-22 years.[150] The app (BodiMojo) is no longer available for download. It aimed to engage youth through mood tracking, customizable colors and daily prompts. The main goal of the study was to assess whether the youth would actually use the app, rather than looking at efficacy. Participants used the app an average of 16.8 days out of a month, with a range from 6-26 days. Nearly all of the youth (92%) rated high enjoyment using the app in a satisfaction survey. The majority reported learning relaxation skills (64%) and planning to continue to use the app (64%). In a focus group youth asked for more specific content in response to the mood tracking, more interaction and

personalization (such as calling an individual by name or remembering previous emotions entered).

Evaluation of Mindfulness Technology. The popularity of mindfulness and its spread into new settings is happening at such a pace that research can struggle to keep up, as is the case in technology-based mindfulness.[151] There is a need for research on effectiveness of mindfulness apps. [143,152] It is important that the quality of mindfulness training be maintained in order for efficacy to also be maintained.[138,151] The core ingredients of successful mindfulness interventions must be clarified as it branches into technology, so as to maintain the integrity and fidelity.[151] MBSR and Mindfulness-Based Cognitive Therapy (MBCT), termed first generation mindfulness programs, are distinct in that they: ensure evidence-based practices to manage mental and physical well-being, are suitable for delivery in a wide range of contemporary settings, and are accessible to people of diverse religious affiliations and backgrounds.[151] Mindfulness-informed practices have evolved to second generation (openly spiritual and linked to Buddhist teachings) and third generation (focus on themes of acceptance and relating to experiences, with decreased emphasis on controlling internal experiences); however the first generation approaches have the strongest evidence backing their use.[151]

In a 2015 review of 700 mindfulness apps found on the iTunes store, Mani et al. found that only 4% actually provided mindfulness training and education.[152] Many other apps claimed to be mindfulness-related however were simply timers, audio relaxations or reminders for example. Who develops the app is often unclear, though it is likely to be as important as an effective teacher in face-to-face mindfulness interventions.[138,152] The constant change in what apps are available also presents a challenge; the majority of apps that have been studied in randomized control trials are no longer available to be downloaded.[140] Looking at traits of what effective

mindfulness apps should have versus evaluating specific apps might be a way to address this challenge. In 2015 Sliwinski, Katsikitis and Jones discussed ways technology might fit within each of the eight factors of mindfulness presented in the Comprehensive Inventory of Mindfulness Experiences (CHIME): [153,154]

1. *Awareness towards inner experiences*: Users need to move out of a solely virtual world experience. This might be accomplished by guiding concentration on a part of the body, or to sensations caused by the breath, or counting breaths.
2. *Awareness towards outer experiences*: The focus is more on internal experience in mindfulness training, which can lead to increased outer awareness too. The authors suggested modelling a realistic world in any virtual activities.
3. *Acting with awareness:* Functions that that help users to stay in the present rather than wandering to thoughts of the past or future or games that require focus.
4. *Acceptance*: Repeated training to shift to non-judgment and self-compassion.
5. *Decentering*: Technology that helps with non-reactivity and pulling away from identifying with thoughts.
6. *Openness to experiences:* Encourage the user to try out new things and to cultivate an open mind. For example daily suggestions of challenges such as walk backwards for a few minutes.
7. *Relativity of thoughts:* Confronting users with different beliefs than their own or using visuals and illusions that change perception help users to see the subjectivity of thoughts. The authors pointed out that training the relativity of thoughts is a novel idea still for app development.

8. *Insightful understanding*: Any pieces of technology that can be included to help users spot negative connotations or subjectivity.

A second review done by Sliwinski, Katsikitis and Jones in 2017 used the Self-awareness, Self-regulation, and Self-transcendence (S-ART) framework to evaluate apps.[149,155] The authors provided suggestions as to how each of five facets of the S-ART can be met by mindfulness apps:

1. *Intention and motivation*: Including gamification, journaling, customizable feedback and social pieces to apps.
2. *Attention regulation*: The authors did not include this piece as it was covered in the previous review using the CHIME tool.[153]
3. *Emotion regulation*: Tools to increase awareness of breath and biofeedback mechanisms.
4. *Prosociality*: This is a new piece in research where ethical virtue development is included as a piece of mindfulness. The authors suggested including moral dilemmas or empathy-provoking in games.
5. *Self-transcendence*: Including self-reflection, visualization and biofeedback technology that immerses users in a virtual world can help on the journey to openness, insight and decentering.

Culbert wrote a commentary on technology available for mind-body awareness and relaxation in children and teens, providing valuable clinical experience and advice in an area where research is lacking.[137] He suggested a variety of apps to help with breathwork, biofeedback, imagery, meditation and yoga; these apps are not necessarily validated but fit with his clinical judgment of what skills youth should build and what he has used in his own clinical experience. Mani et al.

evaluated mindfulness-based iPhone apps available in Australia using the Mobile App Rating Scale (MARS).[152] The MARS was designed to evaluate a broad range of health-related apps, and does have high internal consistency (an alpha Cronbach value of 0.9).[156] The MARS was designed to be used by health experts to evaluate apps for adults, so does not consider the uniqueness of what youth might be looking for in an app.

When cross-referencing the apps suggested by Culbert and those included in the Mani et al. review, three apps for mindfulness overlapped: *Take a Chill*, *Stop Breathe Think*, and *Smiling Mind*. *Take a Chill* has a fee associated with it, which was expected to be a deterrent to youth, while the other two apps are available for free. The last update to *Take a Chill* in the iTunes store was five years ago, so it appears it is not being updated to keep up with the ever-changing smartphone technology.

Summary of mindfulness and technology. In summary, current research suggests technology-based mindfulness is a feasible option for increasing the scale of mindfulness. Evidence from a systematic review concluded similar results can be obtained using technology to deliver mindfulness rather than an in-person facilitator for adults (observed in depression, anxiety and stress). There are no strong studies examining mindfulness delivered via technology for youth, however it seems plausible that these results could transfer especially with the tendency for youth to connect with technology. In the ever-changing technology environment, it can be a challenge to maintain the fidelity of mindfulness training in an app. The CHIME and S-ART both provide a framework for evaluating an app against established factors of mindfulness.

2.5 The Current Intervention

The current intervention aimed to provide evidence-based mindfulness training, that included both facilitator and technology-led practices with a trauma-sensitive lens. Learning to BREATHE was chosen as its effectiveness is backed by research and its structure provides guidance but also allowed for adaptations throughout.

2.5.1 Learning To BREATHE: A Mindfulness Curriculum for Adolescents

Learning to BREATHE is an evidence-based curriculum, adapted from MBSR and designed to be relevant to adolescents in a short format.[52] The original pilot study in 2009 for Learning to BREATHE took place in a private high school setting with 120 senior girls who participated during their health classes.[54] A control group was created with 30 junior female students from the school, though only 17 completed all the assessments. This is a small control group and the authors noted the limitation of using a younger group of students as the control as much maturation occurs throughout high school. Significant differences were found in negative affect and self-acceptance between the intervention and control group. Within the intervention group, statistically significant positive changes were found in emotional regulation (e.g. increased emotional awareness) and somatization (e.g. decreased feelings of overtiredness or aching).

In 2013, a study then tested the Learning to BREATHE program with 216 public high school students. Two schools participated, matched on school-level demographics such as ethnicity and graduation rates. Students from one school were assigned to the intervention (35% male) and students from another school to control (33% male).[55] Significant improvements were observed in perceived stress, emotional regulation, and psychosomatic issues in the intervention group compared to the control.

In 2017, the curriculum was used at an alternative high school in a small sample ($N = 23$) of mostly male students, many of who were from refugee or marginalized families.[157] A pre and

post design was used. Significant changes in self-esteem and perceived stress were observed post-program between groups, but no differences were found on mindfulness scores. Qualitative findings suggested youth valued the self-regulation, awareness, and positive thinking they gained from the program.

Another alternative school was the setting for a 2015 randomized trial comparing the Learning to BREATHE program (n = 14) to an active control class on substance abuse (n = 13).[158] Participants were ethnically diverse, 25% received mental health support, 40% were court-involved and a large majority were failing at least one class at school. The authors discussed many challenges with introducing mindfulness to this group of youth, such as participants being disinterested and disruptive. Changes were made midway through that helped with youth's focus and perceived value of the program. These changes included moving to the gym instead of a classroom (for more space and to avoid any negative connotations a classroom setting had), involving a school staff member known to the youth and decreasing the length of sitting mediation while lengthening mindfulness of the body activities (e.g. body scans and restorative yoga). Depression symptoms improved significantly more in the intervention class than the control class, though the sample size for this study is small.

In 2018 Felver et al. completed a small trial with 29 high school students.[57] Participants were ethnically diverse, with low graduation rates and high poverty rates. The six-session Learning to BREATHE curriculum was delivered to one class randomized to receive the intervention (n = 18), while another class served as a control (n = 11). Students in the intervention group reported stable levels of psychosocial resilience, while students in the control group reported reductions in resilience.

Learning to BREATHE was also used in a 2017 study looking at diabetes and depression outcomes, a novel application of mindfulness.[159] Participants were 12-17 year old females at risk for diabetes (based on weight and family history) and with mild-to-moderate depressive symptoms. A parallel group randomized control trial design was used, with 17 participants randomized to the Learning to BREATHE program and 16 participants to a cognitive-behavioural depression active control group. Both groups attended weekly one-hour long sessions for six weeks. A reduction in depression symptoms was observed in both groups, though it was significantly greater in the mindfulness group immediately after the intervention and at six-month follow-up. Immediately after the intervention encouraging results were found in reduced insulin resistance and fasting insulin in the mindfulness group (both significantly different from the active control group), however the difference did not continue at six-month follow-up. Both groups saw reductions in anxiety and increases in mindfulness, with no significant between-group differences.

Summary of Learning to BREATHE. The Learning to BREATHE program has shown encouraging results in a variety of settings, including youth facing adversity, so has been chosen to guide the current mindfulness intervention. No systematic reviews or meta-analysis have been done on the program, however several randomized control trials in diverse populations observed significant improvements in emotional regulation, anxiety, self-esteem, perceived stress and psychosomatic symptoms. Broderick describes that she created the Learning to BREATHE program to allow for flexibility, rather than as a manualized curriculum.[52] The program was used to provide structure and themes for the current intervention, then sessions were adapted to include technology. The overall goals of the program are to address emotional regulation and stress-reduction in relatable ways for teens. This fit with my hypothesis that mindfulness could

reduce engagement in unhealthy coping behaviours through increased emotional regulation skills.

2.5.2 Program overview

The Learning to BREATHE program places an overarching focus on empowerment, helping youth to gain an inner edge, and addresses six themes (together with empowerment these form the acronym "BREATHE").[52] Pieces of psychoeducation and understanding how stress affects the body are woven throughout. Each of the themes and key suggested activities are described below:

1. *"B" Listen to your body:* This theme focuses on having youth becoming aware and mindful in a non-judgemental way. The idea of mindfulness versus mindlessness is introduced. Suggested practices include mindful breathing, body scan, and mindful walking.
2. *"R" Reflections (thoughts) are just thoughts:* Inner-self talk is the focus of this theme, not allowing thoughts to take control and to develop balance within oneself. A mindfulness of thoughts practice is used in this session.
3. *"E" Surf the waves of your emotions:* This theme focuses on self-awareness of emotions and understanding how these feelings can affect overall wellness. The tendency to cover-up or judge emotions is also be included, which fits well within the objective of this study for youth to understand how emotions might lead to unhealthy behaviours. Mindfulness of feelings or a gratitude practice is used.
4. *"A" Attend to the inside and the outside:* The effects of chronic stress in the body are discussed. Paying attention to what is going on inside the body or in thoughts and

emotions can be a way to reduce stress or build awareness of stressors. Mindful movement is the focus of the practice at this session.

5. *"T" Try Tenderness (Kindness)—take it as it is:* Kindness, especially to oneself, is an important piece in building overall wellness. This theme focuses on self-care, training the mind to support well-being and happiness. The practice is loving kindness.
6. "*H" Practice healthy habits of mind*: Healthy mental habits are connected to healthy physical habits. This session discusses bringing mindfulness to everyday life and strategies for reducing stress. Suggested practices include a body scan or love and kindness.

2.5.3 Program adaptations for the current intervention

The Learning to BREATHE program remained true to the curriculum, while including adaptations to include technology and suit the alternative school setting. Process evaluation assessed how these adaptations were implemented. Chapter 3 explains the methods used for this evaluation.

Use of technology. To introduce youth to mindfulness practices they can access at home, some practices were delivered via technology. The Learning to BREATHE program does come with a CD, however with the rapidly changing technological environment youth are now unlikely to have a device to play CDs so apps were used instead. For the current intervention, it was decided to use the apps *Stop Breathe Think* and *Smiling Mind*, which were both recommended in the reviews done by Culbert and Mani et al.[137,152] Both *Stop Breathe Think* and *Smiling Mind* are available through for Apple and Android devices, as well as having web-based resources.

Alternative school setting. Alternative high schools are designed to support youth with needs that typically cannot be met in a regular school setting. Academic, social and emotional skill building is supported through flexible learning opportunities and innovative programming.[160] Consideration was given to adapt the program to an alternative school audience. Facilitators were encouraged to be flexible, understanding that changes to may be necessary as they got to know participants and group dynamics. We were sensitive that literacy skills may be low, based on discussions with teachers. Less written activities were included, and students were provided with options to draw or work with others when handouts were used.

When running a mindfulness program for alternative school students, Wisner and Starzec discussed how caring relationships were important as students were likely to have found school unsupportive in the past.[125] A meal was served before each session for students, facilitators and research staff to share together. An atmosphere of safety and trustworthiness was created by having a classroom teacher and familiar support staff present at each session. The setting was a classroom youth were familiar with. Mutuality and peer support were developed as all participants, facilitators and observers participated in the same mindfulness practices and discussions. These pieces of creating a supportive environment fit also within guidelines from SAMHSA on trauma-informed programs.[135]

In the current intervention youth were not asked to identify trauma experiences or symptoms; however steps were taken to develop the program with a trauma-sensitive lens. In another pilot study using Learning to BREATHE with an alternative school, focus group discussions revealed that some participants experienced emotional discomfort during certain mindfulness practices, such as body scans.[157] Though this was only identified by some participants, the authors suggested this was an important reminder to acknowledge the possibility of past trauma and

encourage youth to engage in mindfulness practices at a level that works for them. This idea of choice and empowerment is consistent with mindfulness training; however youth may need more reminders to choose for themselves rather than follow peers. Even when technology was used in the present intervention, practices were introduced with a safety message to encourage youth to choose what feels right for them (e.g. eyes open or closed, sitting on a chair or the floor) and that each person's experience with mindfulness is different. The practices in the manual and on the apps do encourage specific actions or ask participants to discuss where in the body a sensation might be felt. If someone is experiencing symptoms of dissociation from trauma, they may not feel connected to their own body and be uncomfortable trying to follow certain cues. Youth were encouraged to choose what level they wanted to engage and reminded to listen to what was right for them. In several spots in the Learning to BREATHE program, Broderick does suggest that certain practices be used over others to avoid retriggering youth that have experienced trauma.[52] Guided mindfulness activities were used, rather than youth sitting in silence. The program facilitators and school staff watched for signs that a participant may have been triggered or overwhelmed. Participants were encouraged to talk to someone if needed, and a list of local mental health resources always available.

2.6 Summary and Conclusion

Smoking tobacco is one of the top factors contributing to the cancer burden in Alberta and worldwide.[29,161] Sugar-sweetened beverage consumption is an emerging contributor to cancer that is of concern in Canada, given consumption is increasing and already above recommended limits.[36,76] Adolescence is an opportune time to address health-risk behaviours before they become habits that extend into adulthood. Typical approaches for preventing cancer-risk behaviours focus on education, especially on a sole behaviour. Rather than addressing behaviour

in isolation, there is a call for broadened interventions that acknowledge the underlying reasons for engaging in these behaviours.[3,4,96] There are limited examples of interventions that go beyond education to address root causes of cancer-risk behaviours among youth, such as chronic stress and trauma. This is especially important to consider for Indigenous youth who continue to face the effects of historical and ongoing colonization and intergenerational trauma in their lives. Childhood trauma has been linked to a variety of poor health outcomes such as increased cancer risk, tobacco use, and bodyweight. Mindfulness has the potential to mediate the relationship between stress and health-risk behaviours, offering healthy coping skills to youth instead. Mindfulness may alter brain regions involved in emotion regulation, attention and self-awareness, though this research has largely been done in adults. Literature surrounding mindfulness in youth is expanding, and there are now several examples of mindfulness interventions adapted for at-risk youth. Emerging research suggests psychological (e.g. improved emotional regulation and decreased perceived stress) and physiological benefits (e.g. lower cortisol levels) for youth who engage in mindfulness interventions; however the field remains new and in need of more research. With the many adaptations of mindfulness training delivered to youth it is unclear what specific components lead to benefits. The use of technology in mindfulness interventions is an area of recent interest in the literature, offering potential to expand the scope of mindfulness and a possible way to engage youth.

The present study used the Learning to BREATHE program, an evidence-based program adapted from MBSR to be relevant to adolescents. Literature supports the efficacy of this program in building emotional regulation skills in youth. The program was adapted to incorporate technology and fit an alternative school setting. This process evaluation was undertaken to assess

the fidelity of delivering the adapted program and to understand youth engagement and experience in the mindfulness program.

CHAPTER 3: METHODS

This thesis is a process evaluation to understand program adaptation, youth engagement and the experience of youth participating in a mindfulness intervention delivered to junior high students attending an alternative school. This process evaluation is the first step of CRIS-Youth, which aims to understand the impact of a mindfulness intervention on cancer-risk behaviours among youth.

3.1 Program Setting

This project began with an extensive community planning process to determine how and where to run a youth mindfulness program in Lethbridge. This included consultations with senior administration across school boards, school staff, school social workers, teachers and Indigenous stakeholders. Through this process it was determined the program would be piloted and run exclusively within an alternative school. Alternative schools commonly provide educational opportunities for vulnerable youth outside the traditional schooling system.[162] For this thesis, we worked with the Lethbridge Alternative School Program located within Victoria Park High School. The school aims to provide a safe and supportive environment with flexible programming.[163] Opportunities for academic, social and emotional learning are provided. Students who want to enroll at this school must be referred from an administrator or counsellor at a traditional school in the area. The majority of students are in grades 9-12, with a small class of students in grade 7 and 8. This thesis focused on a process evaluation of the Learning to BREATHE program that was conducted January-March 2020 with 17 junior high students (grades 7-9) enrolled in this alternative school program. All students registered in the junior high program when data collection began consented to participate.

Ethics approval was obtained from HREBA Cancer Committee (HREBA.CC 18-0350_REN1). Classroom teachers and educational assistants invited youth to participate in the study. For this first cohort, inclusion criteria were defined as: youth currently attending the alternative school junior high program for the 2019-2020 school year; who identified as male, female or gender-diverse; and who were able to provide fully informed written consent and parental/caregiver written consent (see Appendix B for consent forms). Both consent forms were written with simple language to help with readability, while adhering to the HREBA guidelines.

Three facilitators, two per session, led the intervention. These facilitators had no pre-existing relationship with participants or the school. Each facilitator had experience working with youth, had completed mindfulness training, and had their own active mindfulness practice. None of the facilitators had used the Learning to Breathe curriculum before the intervention, though each reviewed the manual and discussed each session at planning meetings held before the intervention program began.

3.2 Program Delivery

During our community planning process, we determined that the Learning to BREATHE program would be adapted for delivery over eight sessions, rather than the six or eighteen options in the curriculum. A first session was added to provide a general introduction to mindfulness and allow time for facilitators to get to know participants. A final session was added to focus on the overarching theme of empowerment, reinforcing the message of inner strength and healthy coping skills shared throughout.

Appendix C contains an example outline for a session we delivered. The program was designed to include technology and increased trauma sensitivity, while following the Learning to

BREATHE curriculum. Broderick describes the Learning to BREATHE program as flexible, rather than as a manualized curriculum.[52] Broderick recommends three key elements that should be included in each session: introduction of the theme, activities to develop the theme, and mindfulness practice.[52] In planning the intervention, we worked to ensure these three elements would be present in each session. We also used mindful breathing and movement for transitions between components within a given session, as recommended by the manual. We also provided youth with small gifts at the end of sessions to thank them for attending, and to remind them of a moment they could practice mindfulness between sessions. For example, at session five each youth was given a small bottle of shampoo and coached that this could be used to practice the theme of attention. Youth were encouraged to pay attention in a mindful way while washing their hair such as noticing how the shampoo smells, the temperature of the water, the feeling of bubbles, or if any thoughts were present.

To introduce youth to mindfulness practices they could access at home, some practices from apps were delivered over a Bluetooth speaker. An app-led practice was used when one similar to that suggested in the curriculum was found. Practice time for youth is suggested to be between five to 15 minutes, or equaling minutes of practice time to the age of participants.[120,121] All practices were under 10 minutes long. The mindful breathing at the beginning of class used a combination of facilitator-led and technology-led delivery, providing youth with examples of mindful practices they could use at home. We decided to use the apps *Stop Breathe Think* and *Smiling Mind,* which were recommended in reviews by Culbert and Mani et al. for youth learning mindfulness.[137,152] Both are available free for Apple and Android devices, and can also be accessed directly on the internet using a desktop computer. Wallet cards with information on how to access the apps were distributed twice during the program.

Consideration was given to adapt the program to an alternative school audience. A meal was served before each session, recognizing the importance of taking time to build relationships.[125] Facilitators were encouraged to be flexible, understanding that some changes may be necessary as they got to know participants and group dynamics. We were sensitive that literacy skills may be low, based on discussions with teachers. Fewer written activities were included, and students were provided with options to draw or work with others when handouts were used. The intervention was developed and delivered with a trauma-sensitive lens, including creating a supportive environment that fit within guidelines from the Substance Abuse and Mental Health Services Administration (SAMHSA).[135] The setting was a familiar classroom and a teacher or educational assistant known to youth was always present. Safety messages were used to encourage choice of how to participate in a session (e.g. how to sit, eyes open or closed), regular reminders that each person's experience with mindfulness is unique were shared, and ground rules were established as a group. Program facilitators and school staff watched for any participants that may have been triggered or overwhelmed.

3.3 Process Evaluation Strategy

My goal for this thesis was to understand the degree to which the Learning to BREATHE program was implemented as planned and the quality of implementation. Process evaluation can provide valuable information for program planning.[164] The outcomes of this thesis will be used to strengthen the delivery of this program for future cohorts**.** To frame my work I engaged the step-wise approach recommended by Saunders, Evans and Joshi (2005) for evaluating health promotion programming.[165] I also incorporated recommendations by Sharma et al. (2017) to further supplement this process evaluation strategy.[166] The steps used were: (A) describe the

intervention and program goal; (B) describe complete and acceptable program delivery; (C) develop a list of process evaluation questions; and (D) determine methods for process evaluation.

A. **Describe the intervention and program goal:** A project logic model (Figure 2) was created to represent the intervention and the broader goals of the CRIS-Youth study.[167] This thesis will focus on the inputs, activities, audience and outputs sections of the logic model.

B. **Describe complete and acceptable program delivery:** Complete and acceptable program delivery was defined based on four elements: fidelity, dose delivered, dose received, and reach in keeping with the framework of Saunders and colleagues.[165] The authors also suggested recruitment and context may be examined; however, since the study setting is a school these are already set and beyond the scope of this evaluation. Building on this framework, Sharma and colleagues include adaptation as an element of their process evaluation, which I have included in my model of evaluation as well.[166] Fidelity focused on the quality of the intervention being delivered, ensuring the program stayed true to the structure and focus of Learning to BREATHE. Facilitator outlines were created for each mindfulness session based on the sequence described in Chapter 4 of the Learning to BREATHE manual.[53] These were adapted to include practices delivered by technology and to reinforce safety messaging. The extent to which these outlines and steps were completed as planned was captured through fidelity forms. The element of dose delivered was captured by how complete the intervention was and how facilitators delivered the sessions. Dose received concentrated on the experience of youth in the sessions, such as how engaged participants were and any value they found in the program. The reach of the program focused on attendance at sessions and if participants practiced mindfulness on their own.

C. **Develop a list of process evaluation questions:** The four elements of acceptable program delivery were considered in creating overall research objectives for this thesis. The research objectives I have selected are:

1. **Program Adaptation:** My first research objective examined how the Learning to BREATHE program was adapted: (a) to include technology, and (b) to suit the alternative school audience.

2. **Youth Engagement:** My second research objective focused on youth engagement, examining youth: (a) attendance and attention at sessions, (b) the effectiveness of facilitators in engaging youth, and (3) levels of home mindfulness practice.

3. **Youth Experience**: My third research objective was to understand youth experiences in the program in relation to (a) changes in their understanding of mindfulness, (b) perceptions about the benefits of mindfulness, and (c) overall impressions of the sessions.

D. **Determine methods for process evaluation**: I operationalized my overall research objectives to determine methods for data collection and analysis. I have stratified the data collection methods used for each research question in Table 1. Data was collected from participant surveys and interviews, attendance sheets, fidelity forms and field notes.

3.3.1 Surveys

Individual surveys were completed at baseline (January 2020) and post-intervention (March 2020). Data collection was completed by educational assistants who students trust and who had signed confidentiality forms. Surveys were completed on an iPad in a private room, with staff reading each question out to youth. Surveys focused largely on outcome data for future evaluations. The baseline survey included questions on demographics (e.g. age, grade, gender)

and the frequency of internet usage. The post-intervention survey asked youth how comfortable and safe they felt during sessions (scaled as most of the time, some of the time, not usually, never). Seventeen youth completed the baseline survey and six completed the post-intervention survey. Qualtrics, a secure online platform, was used to collect survey responses which transferred into a secure software system (IBM SPSS) for analysis.[168] All data were stored with a number, and without any personal identifiable information.

3.3.2 Attendance sheets

Each participant's attendance was tracked by name. Microsoft Access was used to track participants' names and matching identification number. The database was password-protected and saved on a secure drive. At the end of the program, the number of sessions attended by each participant was tallied. If a student arrived at any point after the session had begun or left before the session closing, this was counted as 0.5 of a session attended.

3.3.3 Pre and post interviews

Baseline and post-intervention interviews were conducted by the educational assistants after surveys were completed. Staff asked a series of questions (Appendix D), including additional probing questions if needed. Interviews were audio-recorded and transcribed verbatim with all identifying information removed. Baseline interviews were done with 17 students, and six students also did a post-interview.

3.3.4 Fidelity forms

Fidelity forms were collected from session observers (research assistants) and facilitators after each session (Appendix E). Observers had varying levels of facilitation and mindfulness experience. Fidelity forms were adapted from a composite of various youth programs delivered

in school settings. Questions assessed the fidelity of the intervention, including adherence to program content and adaptations. Facilitators were the ones to assess fidelity to the program, as they were more familiar with the program and session intents. Scaling questions assessed at what level participants were observed to pay attention, participate and act disruptively. The quality of facilitation was assessed by session observers. Scaling questions assessed facilitation processes (e.g. losing track of time, reading from the lesson plan, acting distant) and facilitator delivery (e.g. explaining theme, ability to manage group, providing clear instructions, level of preparation). Fidelity forms repeated the same set of questions for the three facilitators of the program. Forms also had space for open-ended reflection on strengths and suggestions for improvement. The number of fidelity forms completed varied over the eight session, ranging from 2 to 4 completed (mean = 3.4).

3.3.5 Field notes

The research coordinator observed each session and made field notes. This included reporting on the number of practices that were facilitator-led and app-led, tracking who was in the room, and noting general comments. Field notes were available for seven of the sessions.

Table 1. Operationalization of Research Objectives

Research Objectives and Operationalization	Data Collection Instrument
1. Program Adaptation	
i. *Fidelity*: To what extent was each session delivered according to the Learning to BREATHE Program?	Fidelity forms
ii. *Technology*: How many mindfulness practices were delivered via technology versus facilitator-led?	Field notes
iii. *Adaptations for an Alternative School*: At how many sessions were ground rules shared? At how many sessions was a safety message shared?	Fidelity forms
2. Youth Engagement	
i. *Attendance*: On average, how many sessions did youth attend?	Attendance sheets
ii. *Attention*: To what extent did youth participate and pay attention during sessions?	Fidelity forms
iii. *Practice*: Did participants practice mindfulness outside of the classroom sessions?	Survey, post interview
iv. *Facilitation*: How effective were facilitators in sharing session themes and engaging participants?	Fidelity forms, post interview
3. Youth Experience	
i. *Value*: How satisfied were youth after participating in the mindfulness intervention? Did they see value in the program?	Post interviews
ii. *Understanding*: Did participants' understandings of mindfulness increase?	Pre and post interviews

3.4 Analysis Strategy

3.4.1 Program Adaptation

A mixed methods approach was used to assess how program adaptations were implemented while staying true to the Learning to BREATHE curriculum. Microsoft Excel was used to summarize how frequently technology-delivered practices were used, ground rules were reviewed, and safety messages were shared. The safety message included reminders for youth to choose what felt right for them (e.g. eyes open or closed, sitting on a chair or the floor) and that each person's experience with mindfulness is different. Field notes were used to tally the number of mindfulness practices delivered by technology or facilitator for each session. The overall proportion of technology-delivered practices over the entire program was calculated. Answers from fidelity forms were used to count how frequently ground rules and safety messages were shared. Answers to open-ended questions on fidelity forms and field notes were gathered in a Microsoft Word document. Comments related to program fidelity were compiled for qualitative analyses using NVivo 11.0 software to look for themes.[169]

3.4.2 Youth Engagement

A mixed methods approach was also used to assess youth engagement. The number of sessions attended was tallied for the 17 students who completed baseline data collection. The mean, mode and range of sessions attended was calculated. Summary statistics were completed to understand youth participation and facilitator effectiveness. Data were combined from all fidelity forms assessing how much youth participated, paid attention, acted disruptively, and seemed to understand the theme at each session. Responses were given dummy numbers to correspond with the options of "very little", "somewhat", "very much", or "don't know". Fidelity forms answering "don't know" were removed from analysis. The mean and mode for all sessions was

calculated and presented as the corresponding ordinal values. A similar process was done to understand facilitator effectiveness. Data on the three facilitators were combined and answers were dummy coded (assigned numbers for statistical analysis). Questions on facilitator delivery were answered with the options of "very weak, "weak", "acceptable", "good" or "excellent". Facilitation process questions were answered with the options of "never", "rarely", "sometimes", "often", and "very frequently". Average scores were compiled on facilitator delivery and facilitation process for each session, combining answers from each fidelity form for each facilitator. Fidelity forms were removed from analysis if the facilitator questions were left blank, as this would affect the overall score. These scores were reported as the corresponding ordinal category. IBM SPSS statistical software was used to generate frequencies and descriptive statistics.[168] Comments provided on fidelity reports related to the level of youth engagement or facilitation quality were compiled for qualitative analyses using NVivo 11.0 software.[169] To understand participation in mindfulness outside classroom sessions, frequency statistics were calculated from responses to survey questions. This was done using IBM SPPS statistical software.[168] These data were limited with only six participants completing the post-survey. The interviews from these six students were analyzed using NVivo 11.0 software to look for depth.

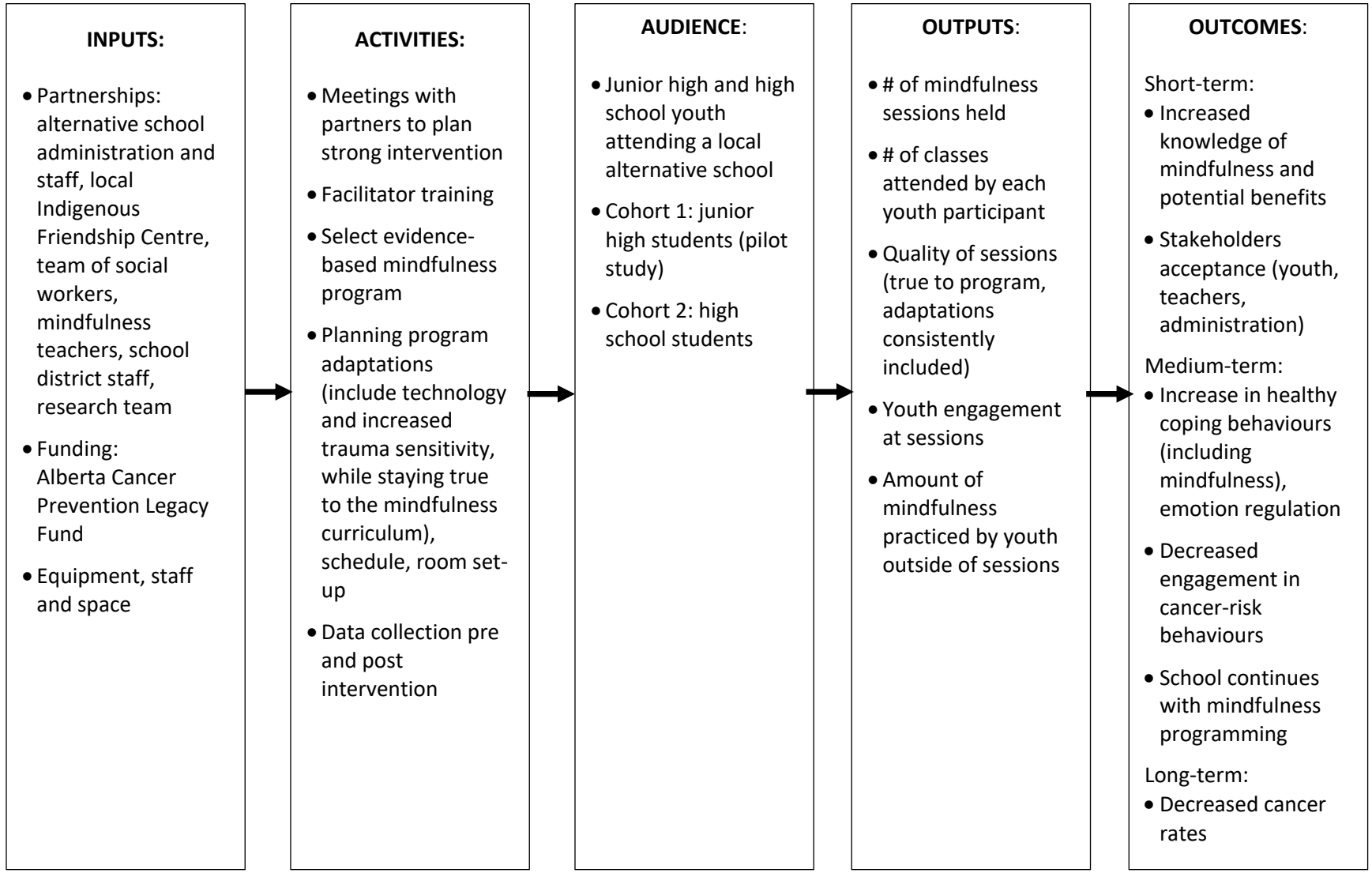
3.4.3 Youth Experience

Phenomenology was used to understand the experience of youth participating in the mindfulness program.[170] The participant interviews were completed with the aim of understanding participants' thoughts, values, and meaning.[171] Interviews from the six participants who completed both pre and post data collection were used. Interviews were semi-structured, with all participants asked the same questions; therefore, it was appropriate to analyze all participants' answers together after data collection.[172] Once interviews were transcribed, I undertook a

phenomenological data analysis approach based on the procedure suggested by Creswell and Poth.[173] Steps for analysis included: (A) identify significant statements from participants and use these to generate themes; (B) understand the what (textural) and how (structural) of participants' experiences; (C) create an understanding of common experiences among participants; and (D) write results, including significant statements from participants.[173] To understand significant statements from participants, I first read through each interview multiple times to familiarize myself with the data and then I coded the transcripts.[174] Fidelity forms and field notes were considered for themes relating to participants' experiences also, as these provided more information on the setting and context in which youth were experiencing the mindfulness programming. I created categories and identified themes to connect participants' experiences. Categories were developed based on interview questions, as suggested by Mayan when semi-structured interviews are used.[172] For example, a category called "feedback on sessions" was created to group answers related to positive and negative impressions of the mindfulness program. Significant statements that captured themes were identified so I could include participants' own words in the results section. Qualitative analyses were completed using NVivo 11.0 software.[169]

Figure 2. CRIS-Youth Project Logic Model

GOAL: To decrease cancer-risk behaviours among youth attending an alternative school through participation in a mindfulness intervention.



CHAPTER 4: RESULTS

This process evaluation sought to understand program adaptation, youth engagement and the experience of youth who participated in a mindfulness intervention held January to March 2020 at an alternative junior high school. Results were analyzed from surveys, interviews, fidelity forms and field notes. Analysis of surveys and interviews focused on data from six students who completed pre and post data collection. A total of 27 fidelity forms were completed, nine from facilitators and 18 from observers, providing information on all eight sessions. Observers completed the section assessing facilitation twice, as there were two facilitators at each session. The completeness of forms varied as some observers skipped sections or questions. Research coordinator field notes were available for seven sessions.

The mindfulness intervention was delivered over eight classes. The average session length was 68 minutes, excluding the meal beforehand. Classes were initially delivered twice a week; however, the final four sessions were delivered over three weeks due to a schedule change as a result of a facilitator switch. Three facilitators were involved in the intervention delivery, all had mindfulness training and experience working with youth. A total of 17 youth participated in the intervention; the majority of whom (65%) were in Grade 9. Eight youth in the intervention (47% of sample) self-identified as Indigenous. Table 2 displays demographic information. All six students who completed post-intervention data collection were in grade nine. At baseline all 17 youth reported accessing the internet daily: 14 (82%) using a phone and six (35%) using a computer.

4.1 Program Adaptation

My *first research objective* was to examine how the Learning to BREATHE program was adapted: (a) to include technology, and (b) to suit the alternative school audience.

Table 2. Demographics

Characteristic	Total *n* (%)
Total sample	17 (100)
Grade	
Grade 7	3 (17.6)
Grade 8	3 (17.6)
Grade 9	11 (64.7)
Age, years	
12	3 (17.6)
13	3 (17.6)
14	8 (47.1)
15	3 (17.6)
Gender	
Male	10 (58.8)
Female	5 (29.4)
Other	2 (11.8)
Self-Identify as Indigenous	
Yes	8 (47.0)
No	9 (52.9)

4.1.1 Technology

The number of mindfulness practices delivered within each session by technology versus facilitator was tallied for each session from field notes. No field notes were recorded for session one, so facilitator fidelity forms and the session outline were used. The number of mindfulness practices delivered at each session ranged from three to four. Apps were used to deliver between one quarter (25%) to two thirds (67%) of each session's practices. Over the entire program, apps were used to deliver 40% of practices. The six youth who completed the post-intervention survey

were asked their delivery preference; two preferred the app, one the facilitator, and three liked both equally.

4.1.2 Alternative School Adaptations

The frequency with which ground rules and safety reminders were shared was analyzed using fidelity forms and field notes. Safety messages were shared regularly at sessions. Field notes were absent for session one; however, notes from all other sessions indicated a safety message was shared. Ground rules were shared at seven of the eight sessions. Fidelity forms showed discrepancy between observers on whether ground rules were shared at sessions two and four; however, field notes from session two agreed ground rules were missed. For all other sessions, fidelity forms and research coordinator notes agreed ground rules were shared. In post-intervention surveys, youth were asked if they felt safe during sessions. Five of the students (83%) responded “most of the time” and one student responded, “some of the time”. When asked if youth felt comfortable to participate, results were split; two participants chose each of the following categories: “most of the time”, “some of the time”, and “not usually”.

4.1.3 Fidelity

To determine the extent to which sessions were delivered according to the Learning to BREATHE Program, facilitators were asked to identify deviations from session outlines on fidelity forms. Additional comments from observer fidelity forms were included in the analysis if they focused on changes to sessions. Overall, minimal changes were made from session outlines. There were no comments regarding changing the structure of sessions, indicating good adherence to the flow and three key elements suggested by Broderick: introduction of the theme, activities to develop the theme, and mindfulness practice.[54] Some observer comments suggested

more time could be spent on the sections introducing and developing themes to ensure understanding. At one session, the mindful movement section was led by a yoga instructor who teaches at the alternative school.

Changes were made to better suit the group as facilitators got to know the participants. Activities occasionally flexed between those suggested in the six- and sixteen-session curriculums, following the same theme. One facilitator chose to include an activity from "T: tenderness" in the session focused on "H: habits", noting the manual suggested this was an option. A facilitator comment noted an activity with lots of writing was skipped as it was "not appropriate for this group", indicating the literacy skills of participants were being considered. When a practice of loving kindness towards others was suggested, the facilitator chose to use a practice focused on self-compassion instead. This rationale was explained as: "For trauma-sensitivity doing a Loving Kindness where you direct intentions to others, especially someone you have bad feelings towards, can be triggering so I wanted to avoid it. I think for this group focusing on kindness to self is where to go."

Strategies that attempted to increase participant engagement were identified across the facilitator fidelity forms. At several sessions short videos were shared to develop the theme. These included a hand model of the brain, a humorous video on positive affirmations, and other short videos explaining mindfulness topics. One facilitator commented: "[The video] was very descriptive, and I believe if students see a visual they understand what we're talking about better." Another comment noted engaging students by asking for volunteers to draw brain sketches on the whiteboard to guide the discussion. For the second half of the intervention a sharing circle was included in the session closing. Everyone (participants, observers, teachers, and facilitators) was

encouraged to share something they learned, how they felt or what they found interesting at the session. Everyone participated, even if it was to share one word, including students who sat silently throughout the session. A suggestion to include more movement and activity for youth emerged from facilitator and observer fidelity forms. This was especially evident in reflections after the last session. This session included smudging, mindful walking, drawing and making glitter jars. Observers shared that youth seemed to enjoy these activities and engage more in the session, including settling into a seated meditation afterwards.

Summary of Program Adaptation. Technology was integrated throughout the program, using app-based practices and videos to develop themes. To better suit an alternative school audience, some changes were made. Ground rules and safety messages were shared regularly; however, there was variation in how safe and comfortable youth reporting feeling at sessions. Some changes were made to encourage more youth engagement, with suggestions that more activity be included in future sessions.

4.2 Youth Engagement

My *second research objective* focused on youth engagement. I examined youth: (a) attendance and attention at sessions, (b) the effectiveness of facilitators in engaging youth, and (3) levels of home mindfulness practice.

4.2.1 Youth attendance and attention

Attendance at each session was recorded for all 17 students. One youth did not attend any sessions, so was removed for attendance analysis. On average, participants attended 5 (59%) of the sessions (mode = 4 sessions, range = 2-8 sessions). The six students who completed both pre and post data collection appointments attended sessions at a slightly higher rate (76%). Fidelity

forms indicated youth were somewhat engaged in the mindfulness sessions. Observers assessed the level participants paid attention, participated, understood the theme, and enjoyed the session. Scores were reported following a scale of 1 for very little, 2 for somewhat, and 3 for very much. A total of 26 observer fidelity forms were used to calculate scores; however, four research assistants responded "don't know" to the question of how much youth understood the theme, so 22 responses were used for that calculation. Data reported here represent the average scores across observers and sessions. Average participation in sessions was ranked at 3 or very much (mode = 2 or somewhat). Mean and mode scores of 2 were reported for how much youth paid attention and seemed to understand the theme. The extent to which youth acted disruptive was ranked at an average score of 2 or somewhat (mode = 1 or very little). Some comments were shared by observers and participants that including more movement would increase engagement. This is discussed further in the youth experience section below.

The highest attention scores (3 or very much) were reported for sessions three (thoughts are just thoughts), seven (practice healthy habits of mind) and eight (review and empowerment). Technology-delivered practices were used for 33% of practices in sessions three and eight, and 50% in session seven. There did not appear to be a connection between number of technology-delivered practices and participant attention scores. Sessions four, five and seven reported low scores for youth disruption. These same sessions also reported above average technology-delivered practices (displayed in Table 3).

Table 3. Technology-Delivered Practices and Youth Disruption

Session	Technology-Delivered Practices[a] (%)	Youth Disruption Scores[b]
1	33	2
2	33	2
3	25	2
4	50	1
5	67	1
6	25	2
7	50	1
8	33	2

[a] Sessions with technology-delivered practice use above the overall average (40%) are highlighted.

[b] Scores are reported as session averages. Answer Choices: 1 very little, 2 somewhat, 3 very much.

4.2.2 Facilitation effectiveness

Facilitator effectiveness was assessed through delivery and facilitation process scores, with data for the three program facilitators combined. Overall scores showed facilitator effectiveness was satisfactory. A total of 28 responses from observer fidelity forms were considered for delivery rating scores, once forms with null values for this section were removed. Scores were reported following a scale of 0 for very weak, 1 for weak, 2 for acceptable, 3 for good, and 4 for excellent. An overall delivery score was calculated for each session. The average score for each question on facilitator delivery was tallied, then divided by 10 for the 10 questions. Scores were converted to corresponding ordinal values. (See Appendix A: Fidelity Forms for details on questions and scoring.) For session five facilitator delivery was ranked as 4 or excellent, while it was ranked as 3 or good for all other sessions. Mean and mode scores were calculated for each question focused on facilitator delivery, with results ranking delivery as 3 (good) or 4 (excellent) (see Table 4).

Facilitation process scores were calculated from six questions on observer fidelity forms. Once null values were removed, 35 observer fidelity forms were used for analysis. Scores were reported following a scale of 0 for never, 1 for rarely, 2 for sometimes, 3 for often and 4 for very frequently. An average facilitation process score was calculated for each session by tallying average scores from the six questions, dividing by six and converting to ordinal values. Session two had an overall score of 0 or rarely and all other sessions had scores of 1 or never, indicating a low level of concern with how facilitators presented and managed sessions. Mean and mode facilitation process scores were calculated for each question (Table 5). This analysis demonstrated that reading from lesson plans while facilitating was identified as a concern.

Table 4. Facilitator Delivery Rating[c]

Rate the facilitator on items below:	Mean	Mode
1. Theme of session was clearly explained at beginning	3	4
2. Acceptance and friendliness	4	4
3. Ability to manage and/or recover the group's energy level	3	3
4. Ability to carry the theme throughout the session	3	3
5. Gave short and clear instructions	3	4
6. Demonstrated how to access mindfulness resources or how to use practices in real-life	3	3
7. Encouraged creative self-expression	3	3
8. Level of preparation	3	4
9. Comfort level in front of group	4	4
10. Engaged participants by making mindfulness training relevant to the youth's lives	3	4

[c] Answer Choices: 0 very weak, 1 weak, 2 acceptable, 3 good, and 4 excellent.

Table 5. Facilitator Process Rating[d]

To what extent did the facilitator act in the following ways…	Mean	Mode
1. Read from lesson plan while facilitating (briefly referring to plan is fine)?	2	1
2. Acted distant (uninterested or uninvolved with participants)?	0	0
3. Was critical of a participant's story sharing and/or activity engagement?	0	0
4. Ended the session too early?	0	0
5. Lost track of time?	0	0
6. The session felt rushed?	0	0

[d] Answer Choices: 0 never, 1 rarely, 2 sometimes, 3 often, and 4 very frequently.

4.2.3 Home Practice

Three of the six students (50%) reported practicing mindfulness outside of classroom sessions on post-surveys. However post-interviews suggested four youth (67%) engaged in mindfulness techniques at home, as one additional student discussed ways they had practiced mindfulness outside of sessions. Three students used apps (though did not provide any details of practices used) and the other student described how he used a finger breathing technique to calm down at home. Students reported using apps other than those used in class during interviews; however, in the surveys one participant reported accessing both the *Stop Breathe Think* and *Smiling Mind* apps. The difference between survey and interview reports highlights the value of using mixed methods research with youth, where the interview responses captured data that would have been missed.

Summary of Youth Engagement. The reach of the intervention was low, given that on average youth attended approximately half of the sessions. Facilitator effectiveness and delivery was satisfactory, though concerns with facilitators reading closely from lesson plans were identified.

Youth were somewhat attentive at sessions. Some youth practiced mindfulness outside of the sessions.

4.3 Youth Experience

My *final research objective* was to understand youth experiences in the program in relation to (a) changes in their understanding of mindfulness, (b) perceptions about the benefits of mindfulness, and (c) overall impressions of the sessions. I used two sources of data to examine this objective. First, I examined the pre-post interviews of six youth. Second, I examined reflections from the research team as another source of data on youth experience from an observer perspective. I used a phenomenological lens to understand the experience of youth participating in the mindfulness program, generating themes from statements youth shared in interviews.[170,173] Questions asked were: (1) How would you describe mindfulness?; (2) Do you think mindfulness helps you? Do you think mindfulness helps others?; and (3) What was your overall impression of the mindfulness classes?. I created categories based on questions youth were asked in interviews. Table 6 summarizes the main themes that emerged from my analysis within each category.

Table 6. Themed Responses to Post-Interview Questions

	Theme and Supporting Quotation(s)
Understanding of mindfulness	***Reasons to Practice***
	Practicing things, and like meditations so that your mind stays healthy along with your body, and so like they can be connected. (P6)
	[Mindfulness] can help you in a positive way, if you just give it a try. (P7)
	Ways to Practice
	Just being aware of your breathing and your thoughts. (P13)
	Anything can really be mindful, if you just-you think it is. (P14)
Relaxation and coping	***Relaxation***
	It makes me more relaxed… you get really really really good sleep. (P5)
	Coping
	I have anxiety so I feel like it helps with my anxiety and being able to like, calm down my mind. (P6)
	[Mindfulness] helped me cope with my behaviors a little bit more I think. (P5)
	Useful for Others
	I don't think mindfulness works for me but it can work for other people. (P15)
Overall impressions of mindfulness classes	***Positive***
	Overall it was a good experience. (P7)
	[I liked] the part where the Australian guy was talking. (P5)
	Overwhelming
	They just stressed me out more. (P15)
	Differing perspectives on engagement
	[I liked] that they kind of engaged students instead of just teaching. (P13)
	It was boring… Because most of the time they are just kind of reading it off of a paper and they were all pretty much robots. (P14)

4.3.1 Youth understanding of mindfulness

During the pre and post interview, youth were asked to explain what mindfulness meant and what activities might be done to practice mindfulness. At baseline their answers were short. The main idea shared was that mindfulness could be used to calm down or cope with bad thoughts. One youth shared that mindfulness was "a way that teachers can help kids learn to cope" (P5). One youth stated he did not know what mindfulness was. Most youth had not practiced mindfulness before. One youth shared doing some yoga in the past, and another briefly mentioned using a Fitbit to relax though did not provide details.

Broadened understanding of mindfulness. It was evident that youth's experience participating in the group sessions shaped a broadened understanding of mindfulness. When surveyed after the intervention youth gave more detailed answers, suggesting a broadened understanding of mindfulness and why to practice it. Youth continued to describe mindfulness as a tool but could now explain more about what they meant by this. For example, one youth shared that mindfulness was something to keep practicing and referenced the brain-body connection: "I guess like, keep having like, practicing things, and like meditations so that your mind stays healthy along with your body, and so like they can be connected I guess" (P6).

Varying ways to experience mindfulness. Participants' understanding of mindfulness post-intervention included examples of ways to practice. Each of the examples shared was something participants had experienced during sessions. The most common theme of how to practice mindfulness was through breathing. Youth talked about using both breathing exercises and awareness of breath. Some youth added awareness of thoughts into their definition also: "[Mindfulness is] just being aware of your breathing and your thoughts" (P13).

Youth were able to share several different ways of how mindfulness could be practiced, demonstrating a marked shift from the pre-interviews. For example, they discussed how mindfulness could be integrated into daily life through formal and informal practices:

> "Just like focusing on like little stuff, so like one of the girls say just like washing your hair instead of doing it like a robot, you can like really like feel like where the soap is and like pay attention to how many bubbles there are and stuff like that." (P6)

> "You could do yoga, you could meditate, you could just take a nice bath, or you could paint. Anything can really be mindful, if you just-you think it is." (P14)

4.3.2 Relaxation and coping

Youth were asked to identify in what ways, if any, they found mindfulness helped them. Most participants had limited or no exposure to mindfulness before the intervention. It was evident from participant feedback that trying mindfulness was a new experience. Most of the youth did express openness to trying mindfulness. Some participants shared comments that included phrases such as "give it a try" or "actually", indicating unexpected results or impressions. For four of the six youth, their experience with mindfulness involved personal benefits. During the post-interview four youth shared ways mindfulness had helped them One youth explained this generally as: "[Mindfulness] is something that can help you in a positive way if you just give it a try" (P7). Relaxation and coping were the main themes shared. Youth found mindfulness helpful to calm down. Comments around relaxation and improved sleep were made to describe how mindfulness helped: "[Mindfulness] helped me cope with my behaviors a little bit more I think… It makes me more relaxed… you get really really really good sleep" (P5) and "I was able to sleep throughout the night and actually go to bed early" (P13). Youth identified mindfulness as a way

to cope. When asked about how mindfulness might help them, one youth replied: “Maybe just like, my anger, like, controlling my anger” (P15). Several youth discussed how mindfulness could help deal with anxiety and calm down, and in turn how this could benefit others. As shared by one youth:

> **“**I have anxiety so I feel like it helps with my anxiety and being able to like, calm down my mind, because when I do like-when I am having like an anxiety attack- it doesn’t happen on the outside it happens on the inside, and my brain spirals like crazy, so I think like meditation would be a really good way to kind of like train my mind and to not spiral I guess….I just think meditation is a really good thing for people, especially if they have like stress and anxiety to kind of just like (pause) calm yourself down (pause) like me if they have anxiety it could help calm their nerves, or like if they had a really crazy day it’s just a nice way to unwind I guess… It’s not just hippie crap.” (P6)

Two of the youth shared a common experience of trying mindfulness and observing benefits for their peers, but not personally. One interview question asked if youth felt there were benefits for others from practicing mindfulness. Two youth reported mindfulness did not help them; however, both shared they felt it could help others. The unique experience of individuals with mindfulness was highlighted:

> “I can see it helping a lot of other people … I guess it just depends on the person, like I’m not one for mindfulness I guess. But I know there are like people out there that are just like yeah I like mindfulness.” (P14)
>
> “Well, like, I dunno I don’t think mindfulness works for me but it can work for other people... Like, just meditating for me like, just doesn’t work.” (P15)

Neither youth shared details on why they felt mindfulness would work for other people rather than themselves. One youth suggested the app-based practices could be something other people use to help with stress. Despite not describing how mindfulness could help them, these youth still described the relaxation or coping parts of this theme when thinking about others.

4.3.3 Overall impressions of mindfulness classes

Youth were asked to share impressions of the mindfulness sessions and what they found to be most and least helpful. Four of the youth shared only positive impressions of the mindfulness classes, even when probed for what they liked least. For example, sharing: **"**I thought all of it was helpful to be honest, like I just think meditation is a really good thing for people, especially if they have like stress and anxiety to kind of just like…calm yourself down" (P6). Participants reported enjoying the mindful practices, specifically breathing, meditations and apps. Multiple students referred to "the Australian guy", which were practices from the *Smiling Mind* app. Relaxation appeared multiple times as a benefit youth identified from mindfulness classes. The way youth described the opportunity to relax suggested they enjoyed this as something novel to their typical school day: **"**[I most liked] when we got to calm down a little bit…I got to lay on the floor" (P7), "They were lots of fun. I got to sleep in them lots, it was nice…Yeah really relaxing" (P5) and "Yeah after like one of the sessions I felt like I could feel in my body that everything had just calmed down. It was nice" (P6). The theme of relaxation was also shared in fidelity forms, with several examples of participants appearing calmer after practices.

Only two of the youth had negative impressions of class to share. Similar to the category on benefits of mindfulness, the youth still shared examples of how classes could be positive for others. Both participants discussed the app-based practices specifically. One participant

suggested these were helpful to include as they benefited fellow students. The other found the voice soothing and nice to listen to, though when prodded as to whether this was helpful said: “I just liked it [the voice], I didn’t find that it helped” (P14).

Two youth shared how they had felt uncomfortable during classes. One participant recalled feeling overwhelmed at a session because there were too many people. This was reported to happen at just the one session and the youth did not elaborate more on the cause or if this meant too many youth or adults or both. This youth still shared largely positive impressions of the classes. Another youth shared that they often felt uncomfortable during mindfulness practices as it added to their stress. Fidelity forms and field notes also shared some details of participants’ discomfort. Observers noted that some students would sit by the door or stay at their desks in the back to avoid joining the circle. At one session a student sat outside the door listening to music, explaining that the meditation made him uncomfortable because it “opened things up.” School staff spoke with youth who left sessions appearing distressed.

There were commonalities in how youth experienced sessions, regardless of whether their impressions were positive or negative. The sessions offered a quiet, calm time for youth. This stillness was the opposite of the typical busyness of their days. For some youth this quiet was a positive as it provided time to relax, though for other youth the stillness led to discomfort.

Opinions on how engaging sessions were differed between participants and among fidelity forms. For some youth, comments centered around engagement were listed under positive impressions of the classes, and for others under negative impressions. One youth shared how they felt facilitator engagement was a strong piece of the classes: “[I liked] that they kind of

engaged students instead of just teaching." (P13) Another participant described their overall impressions of the program as boring, though provided examples of enjoyable activities:

> "Just like, eliminating from like sitting down the whole time, because that got boring, cause I was just looking at someone who was talking for like half an hour, but we never got up, we were just sitting in the chair. But moving around and doing more … I liked it when we did that like rope activity where they said things and then if we ever had that feeling then we would step over the rope and all of that…"(P14)

The boredom seemed to stem from a desire to be moving more and engaging in activities other than sitting meditation. The suggestion to include more activities was also present in fidelity forms, and it was evident that facilitators worked to improve engagement as the classes progressed. Fidelity forms noted changes that were made with the goal of increasing active participation and limiting distractions. The circle was made larger, with youth encouraged to spread out and turn different directions during practices. Ground rules were reviewed more thoroughly in latter sessions, discussing what youth needed to feel comfortable to participate and instituting a rule that if someone left the room they would wait to re-enter until a practice was done. A sharing circle was used to encourage everyone to have the chance to share. Some comments were made on fidelity forms that youth appeared to be more comfortable to participate as the intervention progressed. The same youth who described the sessions as boring also shared the facilitators were like "robots" reading from notes. Concerns with facilitator delivery were also present in some fidelity forms, with suggestions made for better flow between activities and devoting more time to ensure youth understood concepts. Observer feedback also noted many positive traits of facilitators, including working well together and connecting with youth. It was

noted that the transition of introducing a new facilitator went smoothly, and facilitators seemed more confident as the intervention progressed.

Summary of youth experience. Participants demonstrated increased understanding of what mindfulness is and how it can be practiced. The main themes were of mindfulness as a tool that could be practiced through breathing as well as in daily activities. Youth perceived mindfulness to be beneficial for relaxation and coping. All youth agreed mindfulness could be helpful, despite some youth not seeing personal benefits. Youth experienced a shift from busyness to stillness during mindfulness sessions. Overall impressions of the mindfulness classes were positive, though some youth perceived benefits to others rather than themselves. Improvements were suggested to increase engagement, safety and effective facilitation.

4.4 Summary of Results

My first research objective was to understand how the program was adapted to incorporate (a) technology, and (b) the needs of learners at an alternative school. Technology was used to deliver half the mindfulness practices for the intervention. App-delivered practices were well-received by youth. Activities were chosen to suit the group, and facilitators shared safety messages and ground rules regularly. Data were inconclusive on whether these adaptations increased youth comfort and safety to participate. My second research objective examined (a) attendance and attention at sessions, (b) the effectiveness of facilitators in engaging youth, and (3) levels of home mindfulness practice. Low attendance affected the reach of the intervention. Data suggested youth were somewhat actively engaged in sessions. Some youth practiced mindfulness outside of classroom sessions. My last research objective aimed to understand how youth experienced the program, focused on (a) changes in their understanding of mindfulness,

(b) perceptions about the benefits of mindfulness, and (c) overall impressions of the sessions. All youth demonstrated increased understanding of mindfulness and its potential benefits. Youth agreed mindfulness was beneficial, with some youth seeing benefits only for others rather than themselves. Interview data suggested overall acceptance of the program was high. Improvements were suggested to increase engagement, safety and effective facilitation.

CHAPTER 5: DISCUSSION

This thesis evaluated the delivery of a technology-based mindfulness intervention for an alternative school audience. My *first research objective* was to examine how the Learning to BREATHE program was adapted to include technology, and to suit the alternative school audience. My *second research objective* focused on youth engagement, examining youth attendance and attention at sessions, the effectiveness of facilitators in engaging youth, and levels of home mindfulness practice. My *final research objective* was to understand youth experiences in the program in relation to changes in their understanding of mindfulness, perceptions about the benefits of mindfulness, and overall impressions of the sessions. In this chapter, I provide an overview of major findings and discussion for each of the three research objectives examined. I discuss overall strengths and limitations, then conclude with recommendations for future practice and research.

5.1 Program Adaptation

5.1.1 Technology

This intervention used an evidence-based program, Learning to BREATHE. It was important to stay true to the program, while incorporating technology and adapting to best suit the needs of alternative school students. Overall fidelity to the Learning to BREATHE program was high, using activities from the six- and sixteen- session program options. Broderick recommends three key elements for each session: introduction of the theme, activities to develop the theme, and mindfulness practice.[52] These three elements were included in each session, though observer feedback noted variance in the depth of theme development.

Technology was integrated throughout the program, including app-based practices and videos to develop themes. Blending technology with face-to-face facilitation was novel, as previous studies have used only one delivery approach.[138] It has been suggested that a combined approach may mitigate concerns with the quality of mindfulness training delivered through technology alone.[138,151] Two apps were used to deliver practices: *Stop Breathe Think* and *Smiling Mind*. Forty-percent of the practices delivered over the entire program were from these apps. At individual sessions, apps were used to deliver between 25% to 67% of practices. Youth reported satisfaction with the app practices. Using apps offered mindfulness practices that youth could access outside of sessions.[127,137] Technology could also offer the opportunity for mindfulness to be delivered to a class without a mindfulness facilitator present, such as a classroom teacher leading an app-based practice.[138] With future cohorts the classroom teacher could be encouraged to use apps between sessions, to familiarize youth more with available practices.

5.1.2 Alternative School Adaptations

Small changes were made by facilitators to cater to the alternative school audience, such as avoiding activities with writing or choosing trauma-sensitive practices. A group sharing circle was added to session closings midway through the intervention. Wisner and Starzec discussed how, when delivering a mindfulness intervention at an alternative school, their program evolved to better suit the group.[125] Changes included trying different mindfulness practices and working to build relationships with students, considering that students attending alternative programs were likely to have found school unsupportive in the past.[125] Building effective relationships is likely to be especially important for the success of an alternative school intervention. In the current intervention a meal was served before each session to allow for informal relationship

building. Anyone in the room, including classroom teachers and research staff, participated in mindfulness practices and the sharing circles. This was done to establish a sense of mutuality and trust. Guidelines from SAMHSA for trauma-informed programs were considered to create a supportive environment.[135] The importance of acknowledging possible past traumas was suggested in the findings of a mindfulness intervention delivered to an alternative school by Eva and Thayer.[157] To avoid emotional discomfort, youth should be encouraged to engage in mindfulness practices at a level that works for them.[157] A reminder to share safety messages was part of each session's outline for the current intervention. The safety message included reminders for youth to choose what felt right for them (e.g. eyes open or closed, sitting on a chair or the floor) and that each person's experience with mindfulness is different. The safety message was shared regularly. Field notes, which included data on whether safety messages were shared, were missing from session one; however, facilitators did share a safety reminder at the seven other sessions. Session outlines also included time to establish and review ground rules. Ground rules were meant to support youth to participate comfortably. There was some discrepancy within observer fidelity forms as to whether ground rules were shared at two sessions. Observer comments also indicated variance in the level of detail addressed with ground rules. This inconsistency in ground rules could have affected how well a sense of safety for participants was established. There was variation in how safe and comfortable youth reported feeling at sessions in the post-intervention survey. Interviews and fidelity forms shared that some youth became overwhelmed in sessions. No evaluation was done to understand if the use of technology had any effect on participants' perceptions of safety or comfort.

5.2 Youth Engagement

My *second research objective* focused on youth engagement. I examined youth: (a) attendance and attention at sessions, (b) the effectiveness of facilitators in engaging youth, and (c) levels of home mindfulness practice. This assessment of youth engagement captured three elements of process evaluation: reach, dose delivered and dose received.[165] Program reach was assessed through attendance and levels of home practice. Dose delivered focused on the quality of facilitation, building on fidelity assessment. Dose received concentrated on how engaged youth were in sessions.

5.2.1 Reach

The reach of the mindfulness classes was quite low, despite the delivery of eight sessions. On average each youth attended 59% of the sessions. The school struggles with attendance in general, so low session attendance was not necessarily an indicator of youth's desire to participate in the intervention. Observer comments suggested more time should be dedicated to thoroughly develop session themes. Repetition was likely to be especially important with youth missing sessions.

Some youth practiced mindfulness on their own. There was variation between survey and interview responses about how many participants practiced mindfulness outside of sessions. The same was true for whether youth reported accessing the two apps used in the program. Multiple students described the Smiling Mind app as something they enjoyed from the classes. Youth did not specifically name the app, which could indicate they did not know the name. Using technology offers opportunities for youth to practice mindfulness skills on their own however, reports of youth accessing mindfulness technology were low. A lack of home practice is not unique to our study. Quach, Gibler and Jastrowski Mano investigated home practice among 76

youth in a mindfulness intervention.[175] Compliance with home practice suggestions was low, with youth practicing an average of 6 out of 21 days. Practice time was not seen to have an effect on outcome (stress, anxiety, memory). In a review of technology-based mindfulness interventions, Fish, Brimson and Lynch found the amount of practice time was less than in face-to-face interventions.[138] This finding suggests expectations of practice time should not be as high when using technology.

5.2.2 Dose delivered

Observer feedback suggested facilitator effectiveness and delivery was satisfactory overall, which I used to assess dose of the intervention delivered. Concerns with facilitators reading closely from lesson plans were present in some participant interviews and scores from observer feedback. This was the first time facilitators had used the Learning to BREATHE manual and although they had experience leading other mindfulness activities, they did rely on the curriculum to ensure they presented it correctly. Broderick states her goal was not to create a manualized curriculum, but rather to allow for flexiblity.[52] This message may need to be shared with future facilitators more strongly to encourage a focus on facilitating engaging sessions rather than worrying about strict fidelity to the manual. Facilitators may be perceived to be unauthentic if reading from the manual too closely. It is important to acknowledge that students attending an alternative school are more likely to have encountered unsupportive adult relationships in the past.[125] When exploring factors affecting building adult relationships for foster care involved youth, authenticity was found to be an important factor.[176] Reading closely from notes may cause the facilitator to appear disconnected and have a negative effect on relationship building. Depending on their unique circumstances or experiences, youth attending

an alternative school may have differing thresholds for what makes a facilitator effective. After the current intervention some participants shared positive comments about facilitators and reported finding the sessions to be engaging. Relationship-building and facilitator engagement are likely to be important in determining the dose delivered when working with an alternative school audience.

5.2.3 Dose received

Youth engagement scores assessed how much youth participated in sessions, understood themes, and acted disruptive, which has been used to assess dose received in my thesis. Overall scores suggested youth were somewhat engaged in sessions. One youth shared feeling bored in some sessions. Observer feedback also suggested more active involvement and movement. Strategies were employed as the program progressed to increase participant engagement. When Bluth, Roberson and Gaylord used the Learning to BREATHE program in another alternative school, challenges with disruptive and disinterested youth were also identified.[158] The authors reported changes made partway through to space out participants, involve familiar school staff, decrease the length of sitting meditations and increase mindfulness of the body activities. In the current intervention, a similar change was made to increase spacing between participants as sessions progressed. Practice time was kept short throughout, adhering to guidelines suggesting practices for youth be between five to 15 minutes or equaling minutes of practice time to the age of participants.[120,121] All practices were under 10 minutes long. The final session included a combination of hands-on activities to develop the theme (crafts) and active mindfulness practices (smudging and mindful walking). Observer feedback suggested youth were most engaged at this

final session. Initiating these strategies at the beginning of the intervention for future cohorts would lead to more participant engagement throughout.

The desire to include more movement was expressed in youth feedback and in observer comments. Engaging in movement can improve cognition and readiness to learn.[177,178] Physical activity can also have positive effects on adolescent's mental health, such as reduced anxiety.[179] Many mindfulness practices involve being stationary for an extended period of time which can be difficult, especially if someone is distressed.[180] When sharing examples of how mindfulness can be practiced, participants largely offered sedentary examples. Walking practices can be a bridge to apply mindfulness in everyday life.[181] Each mindfulness session included mindful movement stretches, with a longer yoga sequence included once and mindful walking twice. With variable attendance, some youth may have missed the activities that included more movement or perhaps didn't identify these as mindfulness. Including more movement and active mindfulness may have catered to more youth, improving dose received.

5.3 Youth Experience

My *final research objective* was to understand youth experiences in the program in relation to (a) changes in their understanding of mindfulness, (b) perceptions about the benefits of mindfulness, and (c) overall impressions of the sessions. Phenomenological analysis of youth interviewed and observer feedback forms provided an understanding of how youth experienced the mindfulness intervention. These results added to my investigation of dose received.

5.3.1 Understandings of mindfulness

After the intervention, all youth shared more thorough definitions of mindfulness compared to pre-intervention interviews. This increased understanding of mindfulness included reasons to use

mindfulness and ways to practice. Mindfulness was described as a tool, with youth suggesting mindfulness could help relax, relieve stress and improve sleep. The most common theme identified of how to practice mindfulness was through breathing. Youth talked about using breathing exercises and awareness of breath, with some youth adding awareness of thoughts. Youth provided examples of formal and informal mindfulness practices. Despite an increased understanding of the definition of mindfulness and how it could be practiced, youth reported varying levels of practicing mindfulness. It is likely the level of understanding surrounding mindfulness is different than the actual ability to practice mindfulness. A similar result was found when the Learning to BREATHE program was used in another alternative school setting. Eva and Thayer found participants provided many descriptions of mindfulness processes in focus groups, though this did not align with their ability to internalize and use mindfulness tools.[157]

5.1.1 Relaxation and coping

Youth found mindfulness to be beneficial, identifying two main themes: relaxation and coping. Another theme was the perception that mindfulness could be beneficial to others. All youth agreed mindfulness could be beneficial, despite some youth not seeing personal benefits. We did not ask any further questions about why some youth felt mindfulness was beneficial for others, rather than themselves. Relaxation, sleeping and calmness were all shared as benefits of the classes or of practicing mindfulness. The theme of learning to relax has been identified in other interventions, both facilitator-delivered and app-based.[122,150] Relaxation may be linked to early experiences with mindfulness, where the focus on redirection of the mind can lead to a selective inhibition of thinking.[117] This may explain how participants in the current intervention found relaxation to be a benefit, finding an opportunity to take a break from thoughts and worries.

Coping was identified as another benefit, with youth citing how mindfulness could help with stress and controlling behavior. This theme of improved coping is present in mindfulness literature focused on youth. In a systematic review of school-based mindfulness programs, McKeering and Hwang found four of 14 included studies examined coping skills and all reported improvements.[122] Qualitative studies reported themes of perceived benefits on coping and emotion control.[122] Self-regulation benefits were also noted by Wisner and Starzec after delivering a mindfulness program to alternative school students.[125] This theme of coping identified by youth supports my hypothesis that a mindfulness intervention may reduce engagement in unhealthy coping behaviours. Providing healthy coping methods could break the link between the adoption of health-risk behaviours to earlier childhood traumas and social, emotional and cognitive impairment (as explained in Figure 1).[21] With increased emotion regulation skills and healthy coping methods, youth may engage less in risky behaviours such as those linked to cancer.[63,64] With alternative schools it is important to recognize that higher levels of cancer-risk behaviour, previous trauma, and lack of supportive adult relationships may be present.[24,157] Mindfulness can be a primary prevention strategy, providing the opportunity for youth to gain resiliency and coping skills.[39] In a mindfulness intervention for youth in foster care, improvements in coping strategies were noted for youth ages 14-17 years; however, these improvements were not observed in youth 17-21 years. The authors suggested the formative years of younger adolescence were a critical transition point for teaching healthy coping strategies.[46] The majority of participants in the current intervention fit within the younger age bracket, so may have been more open to learning alternative coping strategies.

5.3.2 Overall impressions of mindfulness classes

Youth shared the common experience of trying mindfulness as a new activity. There were commonalities in how youth experienced sessions, regardless of whether their impressions were positive or negative. The sessions offered a quiet, calm time for youth. Mindfulness classes were generally well-received. Participants reported enjoying the mindful practices, specifically breathing, meditations and apps. Some youth shared examples of how the classes were positive for others rather than themselves. This is an interesting finding that has not been discussed in other mindfulness literature with youth. Both participants discussed the app-based practices specifically as something others may benefit from. Perhaps the novel inclusion of technology with the face-to-face mindfulness led to these comments after youth tried something new.

Two youth shared feeling overwhelmed during classes. Youth did not share details on the specifics of what made them uncomfortable, though observers provided more information. Some youth avoided joining the group in general. Other youth would leave the classroom during mindfulness practices, with one participant sharing that meditations "brought things up". Experiencing the stillness of mindfulness sessions may have shifted some participants outside their individual "window of tolerance", which could manifest as overwhelming emotions if hyperaroused.[134] Whether trauma is reported or not, mindfulness can still be beneficial, however trauma-awareness is important.[39] Trauma-awareness is evidently important for mindfulness with an alternative school population. Several studies working with traumatized populations did not offer details about how the intervention was specifically adapted to become trauma-informed. Mindfulness training itself does incorporate elements of trauma-sensitivity, however there is still a need for more research on how to adapt interventions with youth.[39]

5.4 Overall Discussion and Conclusions

5.4.1 Recommendations

This process evaluation will inform the intervention for future cohorts of the CRIS-Youth Study. The Learning to BREATHE program structure and use of technology should continue, though there are some key recommendations to strengthen the intervention. Facilitators should be reminded that the manual is to be used as a flexible guide for sessions, rather than a manualized curriculum. To increase youth engagement more mindful movement and hands-on activities should be included throughout. A group sharing circle, introduced midway through the current intervention, should be integrated into all session closings. Low attendance affected the intervention reach. Future cohorts could consider repeating sessions or following the shorter, sixteen-session curriculum. Including more mindful movement practices and hands-on activities at each session will give all participants exposure to these, regardless of how regularly they attend. Time should be spent thoroughly reviewing the previous session's themes with participants, in case they were absent. Most youth did not access the app-based mindfulness practices on their own. With future cohorts the classroom teacher could use apps between sessions to familiarize youth with this method of accessing mindfulness practices. When an app-based mindfulness practice is used in a session, it is important for facilitators to share the app it was from, so students can access it on their own (e.g., writing the name of the app and mindfulness practice used on the board so students can find it later on). Findings suggest participant safety could also be enhanced, given 1 of the 7 students reported they were not comfortable practicing mindfulness. for more investigation of how to increase participant safety. It is also important for facilitators to restate the ground rules for the program at the beginning of each session, especially if there is fluctuating attendance.

The alternative school was an appropriate setting for this intervention. With innovative programming and emotional learning as focuses of an alternative school environment, we received support from administration and teachers for this intervention. In traditional school settings, time constraints and focus on meeting curriculum outcomes may be a barrier to running mindfulness interventions. The structure of the mindfulness intervention used for the current study could easily be used in an out-of-school setting, though it may be difficult to recruit youth solely to participate in mindfulness. In the current intervention, youth described benefits from mindfulness as an unexpected result of participating. There was a commonality shared amongst youth of experiencing mindfulness as something new. Holding sessions during class-time provided youth the opportunity to try mindfulness, without having to recruit them to attend on their own.

5.4.2 Strengths

It was novel to integrate face-to-face and technology-based mindfulness. This study adds to the limited research in this area, suggesting the integration of technology into mindfulness programming is feasible and acceptable to youth. While including a facilitator diminishes some of the scalability of an technology-only intervention, it is important to find balance between efficacy and scalability.[138]

All youth registered in the alternative school junior high program participated in the intervention, with participants showing varying levels of engagement. This provided a real-world setting to test the program.

Process evaluation can provide valuable information for program planning.[164] This process evaluation provided insight that will shape the mindfulness intervention for future CRIS-Youth

cohorts. A strength of this study was the use of a step-wise approach for process evaluation of health promotion programs. Integrating phenomenology into analysis allowed for the voices of youth to be captured. Including observer and facilitator notes as other sources of data provided structural and textural background to further understand the experiences shared.[173]

The intervention was based on an evidence-based mindfulness program, which is rare in school-based mindfulness programming[43,45,122] This provides the opportunity for future studies to build upon the work.

5.4.3 Limitations

A limitation of this thesis was a small sample size. With the complication of the COVID-19 pandemic, the sample size was smaller than planned. While the voices of the six youth interviewed post-intervention did provide valuable insights into their experiences, interviewing more youth may have provided extra depth across the specific themes. I also was unable to do an outcome analysis due to the small sample size.

There was inconsistency in the number of fidelity forms submitted for each session and how complete these were. Field notes were missing from session one. While there was some information available on each session, missing data may have affected how thorough this process evaluation was. Observers and facilitators completed the forms electronically after sessions, which may have left time for people to forget to complete them. No data were available on when fidelity forms were completed. Observers had varying levels of facilitation and personal mindfulness experience. There was no way to measure inter-observer reliability.

There also was a change in one facilitator partway through the program. This was unplanned; thus, no formal evaluation was done to understand how this change affected the intervention or

youth experience. I was the one to take over as facilitator. I had not been present at any of the previous sessions so had no existing relationship with the participants, though do have extensive experience working with youth. With the importance of relationship building when working with alternative school students, this change in facilitator may have been significant. I felt I was able to build relationships with several of the youth and engage them in activities, especially with those students who often sat on the outskirts. The classroom teacher informally shared that he felt the sessions were flowing well and engaging students more. Only having four sessions together wasn't much time to connect with participants though, especially with low attendance.

5.5 Conclusions

The delivery of a mindfulness intervention blending technology with in-person facilitation was novel and well received. Youth reported high acceptance of app-based mindfulness practices; however, the independent use of these apps was limited. Future cohorts should include more prompts from facilitators to encourage home practice and remind youth of the names of the apps used. More exposure could also come from the classroom teacher, such as having the group do a practice together outside of the mindfulness sessions. This novel area of integrating technology into mindfulness programming shows promise and needs more research. As the popularity of mindfulness increases, a tension exists between increased demand and a limited supply of quality mindfulness facilitators.[138]

Steps were taken to adapt the intervention to alternative school learners; however, results were inconclusive on how much these changes translated into increased feelings of safety and comfort to actively participate. We did not assess for any connections between the use of technology and perceptions of safety. The school struggles with regular attendance. Different delivery methods

could be considered for future cohorts. For example, repeating each theme twice or using the sixteen session curriculum for shorter, more frequent classes. Ground rules and safety rules were reviewed regularly, though the amount of time and detail dedicated to these varied. More explicit ground rules and safety reminders should be repeated regularly, especially with concerns around low attendance. Trauma-sensitivity is important for interventions with alternative school audiences. More research is needed on trauma-informed mindfulness interventions, detailing what is done to increase trauma-sensitivity and assessing whether participants feel safer. Further research is needed to assess the addition of more movement and activity into sessions.

Youth were somewhat engaged in sessions, with changes made throughout to try to increase active participation. Changes made, such as spacing participants out and adding a group sharing circle to close, should be implemented from the start with future cohorts. The last session included the most activities and observers reported high level of youth engagement. Building on this success, future interventions should include more standing practices and activities throughout the program. Thorough review of session themes and previous activities is also important with irregular student attendance.

In conclusion, this pilot study demonstrated success blending in-person and technology-delivered mindfulness programming. Participant reflections were largely positive, demonstrating increased understanding of mindfulness and finding it to be a valuable tool for relaxation and coping. Youth were generally engaged in sessions, though this is an area where improvements can be made. Results were inconclusive on whether adaptations to increase participants safety were successful. Findings from this process evaluation will be used to improve mindfulness interventions with future CRIS-Youth cohorts. Mindfulness offers an innovative, upstream

approach to reducing cancer-risk behaviours among youth. Addressing health-risk behaviours in adolescence can create healthy lifelong habits. Many current health interventions attempt to have individuals make the improbable change from an immediate coping solution to a behavior that is motivated by long-term health benefits. There is a call to look beyond education to address the stress that often underlies engagement in unhealthy coping mechanisms. Given that cancer is the top cause of mortality in Canada, novel interventions that address cancer-risk behaviour are needed.

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Appendix B: Youth and Parental Consent Forms

University of Lethbridge
Faculty of Health Sciences

4401 University Drive
Lethbridge, Alberta, Canada
T1K 3M4

Phone 403.329.2699
Fax 403.329.2668

http://www.uleth.ca/hlsc

Dear Parent of Guardian:

Your teen is invited to be part of a wellness project at Victoria Park High School. This letter has information on the project and a consent form if you choose to have your teen participate.

Study Title:	Youth Mindfulness Project
Lead Researcher:	Dr. Cheryl Currie Faculty of Health Sciences University of Lethbridge 403-332-4060
Student Researcher:	Leslie Prenoslo, Master of Science Student
Funder:	Alberta Cancer Prevention Legacy Fund

WHY IS MY CHILD BEING ASKED TO TAKE PART IN THIS RESEARCH STUDY?

Youth at Victoria Park School are being invited to be in this research study about mindfulness. Youth can take part if they are between 13 and 17 years of age. The project will teach youth about mindfulness to see if that changes how well they deal with emotion and how they cope with stress.

Mindfulness is about taking a bit of time to relax from your day. It is about slowing down, breathing, checking in on how you are feeling. You try, just for a short bit, not to worry about other things going on. It takes practice to do. Mindfulness is a kind of training for the brain to help people deal with stress and feel calmer.

This consent form provides information about this mindfulness project to help you with making an informed choice about if you would like your child to take part. Your child will also be asked if they would like to be part of this project after you have given consent. Taking part in this project is voluntary. There is no cost for your teen to take part. If you choose to have your child participate, they may leave the project at any time without giving a reason. It is no trouble if your child decides to stop being part of this project, and there are no consequences if they decide to stop being part of it. If you decide to have your child participate, you will need to sign and date this consent form. Parent or guardian consent is required for youth to take part.

HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?

We plan to enroll about 60 youth at Victoria Park School.

WHAT WILL HAPPEN DURING THIS STUDY?

Your child will take part in a course about mindfulness with about 15 other students. Youth will be asked some questions before and after taking part in this class.

WHAT ARE MY CHILD'S RESPONSIBILITIES IF I CHOOSE FOR THEM TO BE IN THIS STUDY?

If you choose to have your child participate in this study, they will be asked to:

- Meet with a school counsellor before they participate in the mindfulness course, right after they complete the class, and again 3 months after they complete the class. Each time they will be asked to answer some questions on an iPad and through an interview before and after they take the mindfulness class. This will take about 40 minutes. They do not have to answer questions if they don't want to. They will receive a $10 gift card for their time.
- Come to the mindfulness program at their school 8 times on Tuesdays and Thursdays in the afternoon. We will practice mindfulness and talk about ways of dealing with stress. Sessions will follow the Learning to BREATHE program and be delivered by facilitators with mindfulness training and experience working with youth. Your child will receive a meal at each session they attend..

WHAT WILL HAPPEN IF MY CHILD CHOOSES TO STOP BEING IN THE STUDY?

Your child can choose to stop being in the study at any time. They don't need a reason. We might also withdraw teens from the study if we feel it is their best interest. All information about your child will be destroyed if they stop being in the study.

WHAT ARE THE RISKS OF BEING IN THIS STUDY?

There is a chance that talking about stress could bring up emotions or bad memories. If this happens when your child is answering questions or at a session, we will ask them to let one of the teachers in the room know. Our facilitators have experience working with youth and looking for signs of distress. We will have a certified counsellor or social worker in the room at

all times while we are teaching mindfulness. Youth will be invited to speak to this person anytime they would like. Your child can also contact these numbers if they would like to talk to someone right away: Canadian Mental Health Association Distress Line at 403-327-7905 Kids Help Phone: phone 1-800-668-6868 or text "CONNECT" to 686868 or online chat.

WHAT ARE THE POTENTIAL BENEFITS OF BEING IN THIS STUDY?

Being in this study may or may not be of personal benefit to your child. Learning mindfulness may help your child feel more in control of their emotions, and deal with stress better, or it may have no impact on them.

WILL THERE BE COSTS TO BE IN THIS STUDY?

No.

WILL MY CHILD GET ANYTHING FOR BEING IN THIS STUDY?

Your child will receive a $10 gift card each time they meet with someone at their school to answer questions (once before they take the mindfulness class, and twice after completing the 8-class program). We will also serve a meal in each mindfulness class your child attends.

HOW WILL PERSONAL INFORMATION BE KEPT PRIVATE?

If you decide your child can take part in this project, our team will only collect information they need to see if learning mindfulness helps your child. We will do everything we can to make sure that this data is kept private/confidential. No data relating to this project that includes names will ever be released or published. Sometimes, by law, the researcher may have to release information including names and therefore absolute privacy cannot be guaranteed. However, every effort will be made to make sure that your information is kept private. The only time we would share anything is if your child is at risk of harm. All staff in the program have a legal duty to report child abuse or neglect to the police if it is shared with them in talking or writing. This means that if your child told us that they, or someone else, was at risk of being harmed then we would have to break confidentiality to get help involved. After the study is done, we will still need to securely store the data that was collected. We will keep data and study records stored for 10 years after the end of the study.

WHAT ARE MY CHILD'S RIGHTS AS A PARTICIPANT IN THIS STUDY?

Your child has the right to not attend or take part in any part of this project. They do not have to answer any question before or after the mindfulness program that they do not want to. If you, as the child's parent or guardian, decide you do not want your child to take part in this project, even after you have signed the consent form, you have the right to do so. If you would like to know the results of the Youth Mindfulness Program once it is complete, we would be pleased to share this with you. Note that all results will be combined, so we will not know or be able to share the results for your particular child, but we can let you know how the program impacted youth who took part overall. The project results will be ready in early 2021. Please

contact Dr. Cheryl Currie at cheryl.currie@uleth.ca or 403-332-4060, or Erin at 587-370-1963 and we can mail/email them to you.

Your rights to privacy are legally protected by federal and provincial laws that ensure your privacy is respected. By signing this form you do not give up any of your legal rights against the researchers, sponsor, institutions or their agents involved for compensation, nor does this form relieve these parties from their legal and professional responsibilities.

IS THERE ANY CONFLICT OF INTEREST RELATED TO THIS STUDY?

There are no conflicts of interest declared between the researcher and funder(s) of this study.

WHO DO I CONTACT FOR QUESTIONS?

If you have questions about taking part in this study you should talk to:

Cheryl Currie	403-332-4060
Name	Telephone
Erin Higa	587-370-1963
Name	Telephone

If you have questions about your teen's rights as a participant or about ethical issues related to this study and you would like to talk to someone who is not involved in the conduct of the study, please contact the Office of the Health Research Ethics Board of Alberta. Telephone: 780-423-5727.

UNDERSTANDING AND SIGNATURES

	Yes	No
Do you understand that your child has been asked to take part in a research study?		
Do you understand why this study is being done?		
Do you understand the potential benefits and risks of taking part in this study?		
Do you understand what your child will be asked to do should you decide to take part in this study?		

Do you understand that your child is free to leave the study at any time, without having to give reason or without penalty?		
Do you understand that we will be collecting information about your child for use in this study only?		
Do you understand that by signing this consent form you do not give up any of your legal rights?		
Do you feel that you had enough time to think about the information provided to you, to ask questions, or to talk to others when deciding on your choice?		

By signing this form I agree my child can participate in this study. Please give this form to your teen once

you sign it.

_____

Signature of Parent/Guardian Printed Name Date

STUDY TEAM ACKNOWLEDGEMENT

I believe the person signing this form understands what is involved in this research study and has freely decided to have their child participate.

_____

Signature of Person Conducting the Consent Discussion Printed Name Date

University of Lethbridge
Faculty of Health Sciences

4401 University Drive
Lethbridge, Alberta, Canada
T1K 3M4

Phone 403.329.2699
Fax 403.329.2668

http://www.uleth.ca/hlsc

Study Title:	Youth Mindfulness Project
Lead Researcher:	Dr. Cheryl Currie Faculty of Health Sciences University of Lethbridge 403-332-4060
Student Researcher:	Leslie Prenoslo, Master of Science Student
Funder:	Alberta Cancer Prevention Legacy Fund

WHY AM I BEING ASKED TO TAKE PART IN THIS RESEARCH STUDY?

Youth at Victoria Park School are being invited to be in a project about mindfulness. You are being asked to take part because you are between 13 and 17 years of age; and attend this school. The project will teach you about mindfulness to see if it changes how you feel about your emotions and how you cope with stress.

Mindfulness is about taking a bit of time to relax from your day. It is about slowing down, breathing, checking in on how you are feeling. You try, even just for a short bit, not to worry about other things going on. It takes practice to do. Mindfulness is a kind of training for the brain to help people deal with stress and feel calmer.

This consent form provides information about the project to help you with making an informed choice about if you would like to take part. Taking part in this study is voluntary. You may choose to take part or not. If you choose to participate, you may leave the study at any time without giving reason. It is okay if you decide to stop being part of this project, and there are no consequences if you decide to stop being part of it. If you decide to participate in this project, you will need to sign and date this consent form. You will receive a copy of the signed form. Your parent or guardian will also need to complete a consent form for you to take part.

HOW MANY PEOPLE WILL TAKE PART IN THIS STUDY?

We plan to enroll about 60 youth like yourself at Victoria Park School.

WHAT WILL HAPPEN DURING THIS STUDY?

You will take part in a course about mindfulness with about 15 other students at the school. You will be asked some questions before and after you take part in this class.

WHAT ARE MY RESPONSIBILITIES IF I CHOOSE TO BE IN THIS STUDY?

If you choose to participate in this study, you will be asked to:

- Take part in a one-on-one meeting with a school counsellor before you take the mindfulness course, right after you complete the class, and again 3 months after you complete the class. Each time you will answer some questions on an iPad, and through an interview before and after you take the mindfulness class. This will take about 40 minutes. Your answers to the interview questions will be audio-recorded. You do not have to answer the questions if you don't want to. You will receive a $10 gift card for each meeting ($30 total).
- Attend 8 mindfulness classes at Victoria Park School on Tuesdays and Thursdays in the afternoon. We will practice mindfulness and talk about ways of dealing with stress. Sessions will follow the Learning to BREATHE program and be delivered by facilitators with mindfulness training and experience working with teens. You will receive a meal at each class you attend.

WHAT WILL HAPPEN IF I CHOOSE TO STOP BEING IN THE STUDY?

You can choose to stop being in the study at any time. You don't need a reason and won't get in any trouble. We might also withdraw you from the study if we feel it is your best interest. All information about you will be destroyed if you stop being in the study.

WHAT ARE THE RISKS OF BEING IN THIS STUDY?

There is a chance that talking about stress could bring up emotions or bad memories. If this happens when you are answering questions or in a mindfulness class, let one of the teacher's in your class know. You can also contact these numbers if you need to talk to someone right away: Canadian Mental Health Association Distress Line at 403-327-7905, Kids Help Phone: phone 1-800-668-6868 or text "CONNECT" to 686868 or online chat.

WHAT ARE THE POTENTIAL BENEFITS OF BEING IN THIS STUDY?

Being in this study may or may not be of personal benefit to you. Learning mindfulness may help you feel more in control of your emotions and deal with stress better, or it may have no impact on you.

WILL THERE BE COSTS TO BE IN THIS STUDY?

No.

WILL I GET ANYTHING FOR BEING IN THIS STUDY?

You will receive a $10 gift card each time you meet with us at your school to answer questions (once before you start taking the mindfulness classes, and twice after you complete all 8 of the classes). You will also receive a meal in each mindfulness class you attend.

HOW WILL MY PERSONAL INFORMATION BE KEPT PRIVATE?

If you decide to take part in this project, our team will only collect information they need to see if learning mindfulness helps you. We will do everything we can to make sure that this data is kept private/confidential. No data relating to this study that includes your name will ever be released. Sometimes, by law, the researcher may have to release information including names and therefore absolute privacy cannot be guaranteed. However, every effort will be made to make sure that your information is kept private. The only time we would share anything is if you are at risk of harm. All staff in the program have a legal duty to report child abuse or neglect to the police if it is shared with them in talking or writing. This means that if you told us that you or someone else was at risk of being harmed then we would have to break confidentiality to get help involved. We will ask to record your answers to some questions on an audio recorder to help us remember exactly what you say. Only members of our team will listen to these recordings. The recordings will be kept until they have been typed out onto a computer and then they will be deleted. After the study is done, we will still need to securely store the data that was collected. We will keep data and study records stored for 10 years after the end of the study and then it will be discarded.

WHAT ARE MY RIGHTS AS A PARTICIPANT IN THIS STUDY?

You have the right to not attend or take part in any section of this project. You do not have to answer any question that you do not want to. If you decided you do not want to take part in this project, even after you have signed the consent form, you have the right to do so. If you would like to be told about the results of the Youth Mindfulness Project once it is complete, we would be please to share this with you. Note that all results will be combined, so we will not know or be able to share the results for you as an individual, but we can let you know how mindfulness affected youth who took part overall. The project results will be ready in early 2021. Please contact Dr. Cheryl Currie at cheryl.currie@uleth.ca or 403-332- 4060, or Erin at 587-370-1963 and we can mail/email them to you. Your rights to privacy are legally protected by federal and provincial laws that ensure your privacy is respected. By signing this form you do not give up any of your legal rights against the researchers, sponsor, institutions or their agents involved for compensation, nor does this form relieve these parties from their legal and professional responsibilities.

IS THERE ANY CONFLICT OF INTEREST RELATED TO THIS STUDY?

There are no conflicts of interest declared between the researcher and funder(s) of this study. This means the researchers are only doing this study to see if mindfulness can help teens.

WHO DO I CONTACT FOR QUESTIONS?

If you have questions about taking part in this study you should talk to:

Cheryl Currie	403-332-4060
Name	Telephone
Erin Higa	587-370-1963
Name	Telephone

If you have questions about your rights as a participant or about ethical issues related to this study and you would like to talk to someone who is not involved in the conduct of the study, please contact the Office of the Health Research Ethics Board of Alberta.

Telephone: 780-423-5727

Toll Free: 1-877-423-5727

UNDERSTANDING AND SIGNATURES

	Yes	**No**
Do you understand that you have been asked to take part in a research study?	☐	☐
Do you understand why this study is being done?	☐	☐
Do you understand the potential benefits and risks of taking part in this study?	☐	☐
Do you understand what you will be asked to do should you decide to take part in this study?	☐	☐
Do you understand that you are free to leave the study at any time, without having to give reason and without penalty?	☐	☐
Do you understand that we will be collecting information about you for use in this study only?	☐	☐
Do you understand that by signing this consent form you do not give up any of your legal rights?	☐	☐
Do you feel that you had enough time to think about the information provided to you, to ask questions, or to talk to others when deciding on your choice?	☐	☐

If a potential participant has answered "no" to any question above, please make sure to go over the relevant information with them until they do understand it. **Only once they are comfortable with all the information can you accept their decision to participate in the study.**

By signing this form I agree to participate in this study.

Signature of Participant	Printed Name	Date

STUDY TEAM ACKNOWLEDGEMENT

I believe the person signing this form understands what is involved in this research study and has freely decided to participate.

Signature of Person Conducting the Consent Discussion	Printed Name	Date

Appendix C: Sample Session Outline

A "Attention": Paying attention to thoughts and emotions

Description of Theme: Attention to body, thoughts, and feelings is good stress reduction. Stress comes from external and internal events. Paying attention to how the body feels, what we think, and what emotions we experience prevents the buildup of problems that can harm the mind and body.

Suggested Practices from Apps:

Stop. Breathe. Think.

- Lion Mind (7 minutes, notice distractions but don't follow them)
- Yoga videos

Smiling Mind

- 13-15 Year Olds/Mindfulness 204 > Bite Size Mindful Movement (3 minutes)

Session Outline:

ACTIVITY	DESCRIPTION	TIME
Opening Meal	Participants and facilitators will share a meal. Participants are given name tags and invited to join a circle of chairs. Cushions and pillows are available	30 mins
Introduction	A singing bowl signals the beginning of each session. *(Option: generate the sound from an App such as "Insight Timer" which has a timer option under meditate).* Facilitators welcome participants and briefly introduce the session. Ground rules are reviewed.	5 min
Review of Previous Session	Review BREATHE and theme from previous session (last time we looked at paying attention to emotions and watching them come and go.) Introduce today's theme: "Today we will focus on the A in BREATHE which stands for Attention."	5-10 min
Mindful Transition	Mini Mindful Movement (pages 24-26) Short breath practice (app or facilitator led)	5-10 min
Activities to Introduce Session Theme	How much can you handle? (page 78) What's my limit? (pages 234-235, draw on board)	20 min

Mindfulness Practice	Invitation to return to seated, encouragement to get comfortable for a mindfulness practice, share safety reminder. Mindful movement practice Optional: drawing/journaling for 5 mins	20 min
Invitation to Practices at School/Home	This week try to really be present while washing your hair. Pay attention to how the shampoo feels on your head; what are the thoughts in your head? What emotions are you experiencing? A singing bowl will signal the end of the mindfulness session.	5 min

Appendix D: Interview Questions

Pre-Intervention Questions:

1. What does stress feel like to you? Where in your body do you feel stress?

2. When you find yourself feeling stressed, what are some things you do to feel better?

3. What do you think mindfulness is? What comes to mind when you hear the word 'mindfulness'?

4. Have you ever practiced mindfulness or meditation before?

Post-Intervention Questions:

(Note questions 1 through 3 from pre-intervention were repeated at post-intervention)

1. What was your overall impression of the mindfulness classes?
2. What parts of the mindfulness sessions did you like (if any)?
3. What part do you think was the most helpful?
4. What parts of the mindfulness sessions did you NOT like (if any)?
5. Do you think mindfulness helps you? If yes, how do you think mindfulness helps you?
6. Do you think mindfulness helps others? If yes, how do you think mindfulness helps others?
7. Did you practice mindfulness outside of the classroom?
8. Do you have any other comments you want to share about participating in the program?

Appendix E: Fidelity Forms

Facilitator Form for Mindfulness Session Reflection

Date:_____ Initials:_____ Session #:_____

Please do not include names of people in the program on this form. Please be as honest as possible about what you observed today. You can skip questions that were not relevant for the session today.

1. In your opinion, what went really **well** in the mindfulness session today?

2. Were there **issues** with the **room or equipment**? For example – the set-up, the space, temperature, amount of background noise?

No _____ Yes _____ Please describe:

3. Was a **safety message** shared? (Safety messages might include reminders to choose if eyes open/closed, how to sit, non-judgement, etc.)

4. Did you notice **participants having any frustrations** with the mindfulness curriculum presented in the session today?

No _____ Yes _____ Please describe:

5. Did ***you*** have any **frustrations** with the session today? If yes, how was it handled?

No _____ Yes _____ Please describe:

6. Did anything happen that was **unusual** that affected how well the session went for you? If yes, how was it handled?

No _____ Yes _____ Please describe:

7. In your opinion, how much did the **participants:**

	Very little	Somewhat	Very much	Don't know
Participate in the session				
Enjoy the session				
Pay attention in the session				
Support each other				
Respect each other				
Respect the facilitators				
Understand the intention/theme				
Feel empowered				
Act disruptive				
Leave the group for time alone				

8. Did you make any changes that were **not in the session guide** to better assist you in today's session?

9. Which **apps** were used in today's session?

	Name of app	Location in app	Name of practice	Length	Focus
1.					
2.					
3.					

10. How could **the theme have been delivered better today or reiterated** without making the session longer?

11. Please share **any other comments** about today's session here:

Observer Form for Mindfulness Session Reflection

Date:_____ Initials:_____ Session #:_____

Please do not include names of people in the program on this form. Please be as honest as possible about what you observed today. You can skip questions that were not relevant for the session today.

Scheduled start time: ___:__ Actual start time: ___:___ Session end time: ___:___

Total number of participants: _____

Number of participants arriving after the start of the session: _____

Number of participants leaving before the end of the session: _____

Pre-Session Activities

	No	Yes
1. Were all the materials and equipment available for the healthy lifestyle education session?		
2. Was the group informed/reminded of the expectations or rules for the session?		
3. Were the facilitators on time to adequately set-up and prepare for delivery?		
4. Did the facilitators act friendly and greet participants as they arrived?		

Group Participation

How much did the participants…	Very little 1	Somewhat 2	Very much 3	Don't know 4
Participate in the session				
Enjoy the session				
Pay attention in the session				
Support each other				
Respect each other				
Respect the facilitators				

Understand the intention				
Feel empowered				
Act disruptive				
Comments?				

Facilitator Rating *(Note: This section repeated for each facilitator)*

Delivery Rating

What did this facilitator do **really well** today?

Rate the facilitator on items below	Very Weak 0	Weak 1	Acceptable 2	Good 3	Excellent 4
1. Theme of session was clearly explained at beginning					
2. Acceptance and friendliness					
3. Ability to manage/recover the group's energy level					
4. Ability to carry the theme throughout the session					
5. Gave short and clear instructions					
6. Demonstrated how to access mindfulness resources or how to use these practices in real-life					
7. Encouraged creative self-expression					
8. Level of preparation					
9. Comfort level in front of group					
10. Engaged participants – by making mindfulness training relevant to the youth's lives					

11. Brought an overarching focus of empowerment to the group	No 0	Yes 1	Not Necessary 2

Facilitation Processes

To what extent did the facilitator act in the following ways?	Never 0	Rarely 1	Sometimes 2	Often 3	Very Freq 4
1. Read from lesson plan while facilitating (briefly referring to plan is fine)					
2. Acted distant (uninterested or uninvolved with participants)					
3. Did not respond to questions in an effective manor					
4. Ended the session too early					
5. Lost track of time					
6. The session felt rushed					

Overall Comments about Session

1. In your opinion, what went really well in the session today?

2. Were there issues with the room or the equipment, such as how it was set-up, the space, or the amount of background noise? If yes, please describe.

3. Indicate any areas of concern or conflict among participants:

4. Please describe any unique or challenging situations that arose during this session and how the group facilitators handled it:

5. Do you have any constructive feedback for the facilitators on how to effectively engage the participants?

6. Is there anything else you would like to bring to the Coordinator's attention (referring to a specific activity when applicable)?