

Adapting a Youth Suicide Prevention Program for Rural Communities in the United States:
A Feasibility Study

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Abstract

Rural youth suicide represents a major source of mental health inequity in the United States (US). School-based suicide prevention programs may provide an effective avenue to address this mental health crisis among rural youth. This study's primary goal is to demonstrate the feasibility and acceptability of a novel implementation approach (utilizing teachers from a neighboring school) for delivering the Youth Aware of Mental Health (YAM) program, an evidence-based, universal youth suicide prevention curriculum, to high school students in rural Montana. We will recruit approximately 1300 9th grade student in four Montana schools. Using a non-inferiority design, we will randomize classrooms in each school to be instructed by a teacher from another school (YAM-TE; experimental) or a traditional external instructor (YAM-EXT; control). We will assess program fidelity of both YAM training and implementation via independent observer and instructor-reporter ratings. Youth will complete measures of acceptability at post-YAM and outcome measures at pre-YAM, post-YAM, and 12-month follow-up. Standard and mixed linear and logistic regression models will be used to test the main hypothesis that the YAM-TE does not differ from YAM-EXT regarding fidelity (teachers) and acceptability (teachers and youth). Exploratory analyses will test moderation of the intervention effect (e.g., sex, poverty) and the mediating effect of mental health literacy, belongingness, and perceived burdensomeness on the intervention effect. Results of this pilot study will inform the development of subsequent, fully powered noninferiority trials. Our long-term goal is to scale YAM-TE for implementation across rural US communities or, if culturally appropriate, more globally.

1. INTRODUCTION

1.1. Suicide Prevalence and Risk among United States Rural Youth

Youth suicide is a growing mental health problem and rural youth suicide represents a major source of mental health inequity in the United States (US). Suicide is second only to accidental deaths in causing fatality in US youth aged 12-18 years, and rates have increased nationwide over the past 20 years [1-4]. Rural youth are especially at risk [5-7], with nearly twice the rates of suicides compared to their urban peers [8, 9]. For example, in Montana (MT), the suicide rate among 12- to 18-year-olds of 17.9 per 100,000 well exceeds the national average 6.4/100,000 [1]. Suicide-related thoughts or behaviors also are more common in rural youth; for example, consistently, over the past decade (and as illustrated using the latest available data, YRBSS 2019 [10]), more MT youth than youth across the US reported that they had seriously considered suicide (23.4% vs. 18.8%, $p < .001$), made a suicide plan (19.5% vs. 15.7%, $p < .001$), or attempted suicide (10% vs. 8.9%, n.s.) in the past 12 months [11-13]. Prevalence of these reports of suicide intent or attempts have increased both nationally and in MT over the past few years. Finally, “feeling sad or hopeless to a degree that affected some usual daily activities,” a strong predictor of suicidal ideation and attempts, has been reported by a large (and growing) number of youth [14, 15]. For example, the prevalence rose from 26.1% in 2009 to 36.7% in 2019 in the total US sample and from 27.3% to 36.7% in the MT sample [10].

Various theories have been proposed to explain risk for suicide across diverse age and racial/ethnic groups and across geographic locations, all describing risk as multifactorial across multiple risk domains (individual characteristics, familial or interpersonal, social or cultural [16-20]), and emphasizing negative intrapersonal states (e.g., negative emotions; feeling socially disconnected or a sense of thwarted belongingness; perceiving oneself as unduly burdensome [17]) and adverse life events (e.g., parental loss; maltreatment [21]) as risk-, and positive social norms and relationships as protective factors [22, 23]. Mental health problems are significantly associated with suicide and most decedents

1 with a current mental health problem experienced depression [23, 24]. Connecting at-risk individuals to
2 mental health resources is a key element of suicide prevention [6]. Yet only a minority of those in need
3 do access care, and low mental health literacy and stigma are commonly noted barriers [25-28].

4 Rural youth face increased suicide risk (beyond common risk factors they share with their urban
5 counterparts), including low mental health literacy [29], high mental health stigma [30, 31], lack of
6 mental health services, social isolation [5, 32], poverty, and a pessimistic outlook on the future. Lower
7 mental health literacy among rural vs. urban populations may impede recognition of emotional distress
8 or psychopathology as concerns that warrant treatment [29, 31, 33, 34]. Self-stigmatization and fear of
9 being stigmatized for seeking mental health care may be particularly acute in small communities where
10 “everyone is in everyone else’s business” and where self-reliance is highly valued [34-37]. Many rural
11 states are mental health services “deserts;” for example, in 2019, all MT counties were “Mental Health
12 Care Professional Shortage Areas [38]. In rural states, the combination of vast geographic expanses with
13 low population density, of long distances to and limited availability of mental health services [39], mean
14 that rural youth live in under-resourced settings and represent an under-served population [6, 40].
15 Prevalent household poverty further exacerbates rural youth’s challenges [41] arising from physical and
16 social isolation due to large distances between homes or lack of transportation; from feeling socially or
17 politically excluded due to poverty or minority group status; and from lack of job prospects creating a
18 sense of feeling trapped and hopeless about the future [42]. Individuals residing in rural communities
19 also have been shown to have greater access to lethal means, increasing the likelihood that a suicide
20 attempt will result in death [42-46].

21 These scientific advances in identifying suicide risk and protective factors notwithstanding,
22 research has yielded only modest success in predicting suicide attempts [47-51]. Therefore, experts have
23 called for “upstream,” developmentally tailored suicide prevention programs that strengthen coping and

resilience [52] and readily reach youth [53-56]. In under-resourced communities with under-served populations in the US, schools often are the one public institution accessible to all.

1.2. School-based Universal Prevention Programs are Well-suited for Addressing Rural Youth

Suicide Risk

There is expert consensus that school-based universal suicide prevention efforts are needed to complement targeted or treatment approaches for several reasons [55-60]. One, schools have high reach even in rural or frontier communities: School attendance until age 16 is free and mandatory in all US states, with some states requiring students to remain in school until 17 or 18 years of age [61]; and school districts typically provide free transportation to students for whom walking to school is not an option for health or safety reasons. Therefore, neither poverty nor geographic location should prevent students from school attendance. Two, there is synergy between schools' educational mission and focus on healthy child development and the goals of suicide prevention curricula [55-59, 62, 63]. Moreover, offering a suicide prevention program as part of the regular school curriculum on health and mental health topics ensures efficient and cost-effective intervention access for most youth, even in resource-poor communities [64]. Rural schools often face budgetary challenges that preclude offering a full suite of suicide intervention programs (e.g., targeted prevention or treatment of youth who attempted suicide). Therefore, school authorities favor a universal approach when facing budget constraints [65, 66]. Three, in many rural US communities, schools serve as a location for providing mental health care to youth and their families [40, 42]. Adolescents are reluctant to seek mental health care [67, 68], and those who do access medical care are unlikely to receive mental health care [69, 70]. Hence, school-based universal programs have high reach by not requiring that students access care (unlike suicide screening in primary care) or self-identify symptoms such as depression as problems requiring treatment (as would be the case for targeted prevention). And four, by being offer to all students, universal prevention programs avoid the potential risk of stigmatization arising from targeted prevention [59, 71].

Despite these advantages of school-based universal suicide prevention programs, knowledge gaps remain. Systematic reviews of psychosocial youth suicide prevention studies have noted that, overall, few studies have focused on universal interventions [58], and while there have been studies of interventions designed for *elementary* school children (e.g., the Good Behavior Game [72, 73] or the Promoting Alternative Thinking Strategies curriculum [74]), research of school-based universal suicide prevention programs for *adolescents* is limited. Moreover, except for small pilot efforts, there have been no studies of such programs when implemented in rural schools [59]. We propose to evaluate the effectiveness of an evidence-based universal suicide prevention program (Youth Aware of Mental Health, YAM) when adapted for implementation in low-resource, rural schools.

1.3. Why YAM is a Promising Universal Youth Suicide Prevention Program for Rural Youth

YAM [75] is a manualized, universal suicide prevention curriculum designed for delivery during regular school classes by trained instructors and assistants who are not part of the school staff [75-77]. The YAM program comprises 5 modules, including an initial didactic lesson followed by highly interactive sessions including small group work and role plays that draw upon students' personal experiences. The rationale for using external instructors and assistants rather than school staff for program delivery is that students may be more open to participate fully in interactive class activities (e.g., role plays involving sensitive topics) without fear that revealing personal information might impact how school staff would interact with or evaluate student in the future.

YAM was found superior both in reducing suicide attempts and in cost-effectiveness versus other school-based universal suicide prevention programs in a large European cluster-randomized clinical trial. Specifically, the "Saving and Empowering Young Lives in Europe" (SEYLE) study randomized schools in 10 European countries to one of three youth suicide prevention interventions or a control condition. The sample comprised ~11,000 9th graders. Only the YAM program was found superior to the control condition: Students receiving the YAM program showed significantly reduced suicidality,

including 55% fewer incident suicide attempts and 50% fewer cases of severe suicidal ideation, over one year [75, 76]. Using a payer's perspective and modeling costs of the three active intervention programs and the control group, YAM had the lowest incremental cost per 1% incidence reduction of suicide attempts or ideation and per quality adjusted life year gained [64]. The high scientific rigor of SEYLE and the promising outcomes suggest that YAM is a prime intervention candidate for universal school-based youth suicide prevention.

Beyond its proven efficacy [60], there also are compelling conceptual reasons for selecting YAM as the intervention approach for rural schools. The conceptual model underpinning YAM addresses well some of the needs of rural youth. As illustrated in Figure 1, YAM embraces a strength-based, youth empowerment approach (i.e., is consistent with rural cultures' ethos of self-reliance), yet also corrects stigmatizing beliefs about psychiatric symptoms (e.g., that feeling depressed or anxious in response to stressful experiences is a sign of weakness) and teaches students how to access help when needed. YAM seeks to reduce risk by teaching emotional awareness and emotion regulation skills; positive peer relationships (improving problem solving and decision-making and skills when facing common conflicts or problems); and mental health literacy (recognizing in self or others the need for help; identifying resources; reaching out for help). (YAM implementation details are described in the Method section.)

Insert Figure 1 about here

1.4. Studies Support the Feasibility and Acceptability of YAM as Adapted for Rural US Youth

Evidence supports the feasibility and acceptability of YAM for rural youth in MT and Texas (TX). In a key step toward adapting YAM for US youth and in consultation with the developers of the YAM program [77], Lindow et al. [78] solicited qualitative feedback from two groups of 5 students each who had received the original, European YAM curriculum by certified instructors. Informed by the qualitative work, Lindow and colleagues adapted the training and course materials for US settings (e.g., incorporating idioms and examples based on local events or custom and replacing several role-play

scenarios to be culturally suitable to US youth). This culturally adapted YAM version was evaluated in 11 high schools (81.3% school participation) in TX and MT for feasibility and acceptability [78] and for effectiveness in improving mental health literacy and reducing stigma [79]. YAM was delivered to 1,878 students (9th grade: 91.7%) during regular classes by trained instructors and assistants. Satisfaction surveys among school staff (N=49), parents (N=59) and students (N=398) found that YAM was well-received. Moreover, mental health knowledge and help seeking for depression or suicidal ideation increased, and stigma scores decreased in students who received YAM in the MT/TX study [79].

The MT/TX study team conducted a subsequent feasibility study in 10 small MT schools, changing the delivery format by using trained land-grant Extension agents instead of the original model of external instructors and assistants [80]. Feasibility was measured as the percentage of schools willing to offer the program and acceptability was measured using student ratings. Results suggested that YAM is feasible and acceptable in rural schools. Specifically, 77% of invited schools participated and student ratings were highly favorable: 89.1% of youth rated “agree” or “strongly agree” to “it is a good idea to provide young people with a mental health and risk behavior prevention program in schools;” 70.3% reported they were pleased with YAM; 70.7% thought YAM should be suggested for other schools and 70.1% of youth thought students would find the program appropriate. Future studies should gather more detailed information from students about opportunities for program improvements.

These US-based offerings of YAM were supported by state funding for implementation expenses, enabling schools to offer the curriculum without costs to schools for the recruitment and training of the YAM instructors/assistants or for their time spent delivering the prevention intervention. Our team collected informal feedback from superintendents and school principals about their budgetary resources for picking up implementation costs. The resounding feedback was that the resources required for recruiting and training external YAM staff were unduly burdensome. Instead, school officials expressed a strong preference for their own staff to be trained as YAM program instructors/assistants. Yet, the YAM

1 developers have been firm in their belief that the efficacy of YAM may be undermined if students are
2 being taught by their own teachers. The opportunity for youth to share and utilize their personal stories
3 as the basis of discussions and roleplay scenarios without concern that a teacher may in future
4 interactions (e.g., grading; letters of recommendation, etc.) relate differently to students who divulged
5 potentially sensitive personal information is deemed central to students' engagement with and the
6 efficacy of YAM. To resolve this dilemma, we propose a pilot study to lay the groundwork for a
7 subsequent, fully-powered RCT study testing the efficacy of a novel implementation model for YAM,
8 teacher exchanges (YAM-TE) versus the standard model involving external instructors/assistants (YAM-
9 EXT).

10 **1.5. Study Aims: Exploring the Feasibility and Acceptability of a Teacher Exchange Model and** 11 **Collecting Preliminary Outcome Data for YAM-TE versus YAM-EXT**

12 Our long-range goal is to conduct an RCT study testing the efficacy of implementing YAM using a
13 teacher exchange model (TE) rather than the standard model involving external instructors (EXT).
14 Specifically, we propose to develop an implementation strategy involving neighboring schools
15 exchanging teachers for teaching the YAM curriculum. In each participating school, teachers would be
16 trained to serve as YAM instructors/assistants, but the instructional staff from one school would deliver
17 the curriculum in the designated partner school, and vice versa. Embedding YAM instructors within
18 schools is consistent with expert recommendations for making prevention interventions scalable and
19 sustainable [81].

20 We believe the teacher exchange model would be suitable for communities with more than one
21 middle- or high school or with like schools in close-by (≤ 30 miles) communities. These characteristics
22 apply to a substantial number of MT communities: There are 15/15 Class AA schools (≥ 825 pupils) and
23 17/22 Class A schools (≥ 340 -825 pupils) where exchanges could occur in the same town; there are
24 18/40 Class B schools (>120 -340 pupils) that could partner with near-by town. We envision that the

primary targets for YAM-TS would be Schools AA-B. If proven feasible in our pilot study, the YAM-TE model could be implemented across MT and similar states in the US.

Before embarking on a fully-powered trial, pilot work is needed to answer questions about the feasibility of the proposed implementation strategy, as well as about the feasibility of methodological components such as recruitment and retention of research participants, randomization, assessment procedures, and training protocols. As recommended in a seminal paper on pilot studies [82], because they are by definition underpowered, pilot studies should not use control groups for the primary purpose of testing the differential efficacy of the novel versus original intervention. Rather, inclusion of a control group is advantageous for examining whether different interventions are associated with differential recruitment or attrition, whether randomization procedures can be implemented, and other aspects pertaining to the ultimate implementation of both intervention conditions. A primary focus of pilot studies is feasibility, i.e., whether a study protocol be executed or needs to be modified because some or all elements are unacceptable (e.g., participants decline participation or drop out; participants fail to complete assessments) or do not work (e.g., training fails to result in competent instruction of the program) which can be quantified as described below. Using a non-inferiority design, our pilot study will randomly assign classes to YAM-TE or YAM-EXT to address three aims, described next.

1.5.1. Aim 1: Examine the feasibility and acceptability of the teacher exchange model, YAM-TE.

The proximal outcomes are fidelity (can TE staff deliver the YAM curriculum as competently as EXT?) and the number of YAM sessions taught as scheduled (are TE staff as adherent to the teaching schedule, i.e., available to teach the class, as the EXT staff?). The primary outcomes are acceptability of YAM-TE to students (do students exposed to TE rate acceptability at comparable levels to students exposed to EXT?) and teachers (are teachers willing to endorse the TE model after completion of the pilot study?).

1.5.2. Aim 2: Examine the feasibility and acceptability of the research methods. We will

quantify feasibility of a) randomization as the number of classes who receive the assigned YAM

implementation format/the number of randomized classes; b) recruitment as the number of students who agree to provide assessment data (have parental consent and student assent and attend assessment sessions)/the number of students invited to participate; c) retention as the number of students who completed subsequent assessments (post-YAM; 12-months)/ the number of students who provided baseline data; and d) assessment procedures as the number of students enrolled in the study with at least 90% of item completion, at each assessment point.

1.5.3. Aim 3: Gather preliminary outcome data. A proximal primary outcome (measured at end of the YAM program) is willingness to seek help, and distal primary outcomes (measured at a 12-month follow-up) include suicidal ideation and attempts. Secondary proximal outcomes include changes in students' mental health literacy, help seeking, and psychosocial functioning. We also will measure potential moderators (e.g., sex; family poverty [83]) and potential mechanisms [84] explaining YAM distal primary outcomes (increased: help seeking; belongingness; coping; reduced: perceived burdensomeness; depression [85-87]). We expect non-inferiority of YAM-TE versus YAM-EXT on all outcomes; all analyses regarding our feasibility study's third aim are exploratory.

2. METHOD

2.1. Overview and Study Design

We will employ a noninferiority design (combining implementation and effectiveness methods) [88] and randomize (at each school) course sections to receive YAM-TE (experimental group) or YAM-EXT (control group). As shown in Figure 2, students will be asked to complete a baseline assessment the week prior to receiving the YAM curriculum. YAM will be taught in 5 class periods (60 minutes each), spread across 3 weeks. Post-assessments will be performed upon completion of the final YAM lesson; longer-term program impact will be measured at 12-month follow-up.

Insert Figure 2 about here

2.2. YAM Curriculum and Training

2.2.1. YAM Program. YAM is a manualized school-based universal prevention program designed to raise students' awareness about risk and protective factors associated with suicide; teach them a basic understanding of mental disorders, dispel myths and stigma about mental illness, and educate students about healthcare resources and help seeking; and help students enhance coping skills and emotional resiliency to deal with adverse life events, stress, and suicidal risk [75]. YAM comprises five lessons taught by a trained instructor (aided by an assistant) during regular (60-minute) class periods [89]; an instruction booklet for students within which the core program themes are reinforced; and colorful posters for display in the classroom for the duration of the program that highlight each session's core messages. YAM seeks to empower students to think about, verbalize, and discuss their stressors and mental health concerns, using active learning strategies (e.g., small group work and role-plays) and focusing on real-world scenarios that are meaningful to them. Key topics and pedagogical approaches are shown in Figure 3. The proposed study will utilize an instructors' manual reflecting adaptations reflective of experiences of and the language used by US youth [78].

Insert Figure 3 about here

2.2.2. Instructor Training and Supervision. YAM is taught by a trained instructor with support of an assistant who helps manage the class and lead small-group discussions. All instructors will receive the instructors' manual, student booklet, and classroom posters. In separate workshops, TE and EXT instructors (5-day training) and assistants (1-day training) will be taught by two trainers (certified by the YAM developers and following the YAM training model). In brief, the training involves a combination of lectures, discussion and role-plays covering common psychopathology experienced by youth and how to detect and understand youth psychopathology; youth suicide risk factors; barriers to seeking care; how to create a supportive class environment for discussion of student concerns or interpersonal problems; teaching coping skills and problem solving (stop, think, act, evaluate); handling participation issues such as overly shy students or disruptions; and safely managing at-risk students consistent with school safety

1 protocols and following study protocols such as responding to and reporting adverse events. During
2 YAM implementation, all instructors will participate in bi-weekly supervision meetings (separate for TE
3 or EXT) via videoconference and may request, as needed, consultation with a trainer.

4 **2.3. Participants and Recruitment**

5 2.3.1. Participating Schools and Randomization. We will invite four public high schools in MT
6 that reflect the type of rural school most likely suited for the proposed implementation model: schools
7 need to be large enough to have an adequately sized pool of teaching staff interested in becoming
8 trained YAM instructors and geographically close enough to another school for switching instructors,
9 thus preserving the YAM requirement that instructors do not teach students from their own school. At
10 each school, the entire 9th grade will be organized into sections of 20-25 students based on the grade's
11 course schedule. Given current enrollments, we expect to offer 10-12 sections (5-6 YAM-TE, 5-6 YAM-
12 EXT), per school. Sections will be randomized such that at each school, approximately half of the
13 students will be exposed to YAM-TE (i.e., program delivery by two trained teaching staff employed by
14 another school) and about half of the students will be exposed to the standard YAM delivery format
15 (i.e., two external, trained instructors). By randomizing at the level of section within a school rather than
16 at the level of school, we control for seasonal factors that might affect implementation (e.g., weather
17 related school delays; seasonal effects on mood or health behaviors; etc.).

18 2.3.2. Students. At each school, all 9th-grade students will receive the YAM curriculum as part of
19 their health curriculum during regular school periods and be invited to participate in the feasibility
20 study. Of the approximately 1300 pupils eligible for study inclusion, we expect a minimum response rate
21 (receipt of both parental/guardian consent and student assent) of 55%, for a total study sample of ~ 715
22 youth. There are several reasons for targeting 9th grade students: 1) the original YAM program was
23 designed for and tested among 14-16 year-old youth in the 9th grade; 2) developmentally 9th grade is a
24 stressful transition period for youth in the United States as they are entering high school [90, 91]; and 3)

12-month median prevalence estimates of depression in mid-to-late adolescence are much higher than in childhood (4-5% vs. <1%, respectively) and cumulative probability rising from 5% in early adolescence to 20% at the start of emerging adulthood [92].

2.4. Instruments and Procedures

Our implementation outcome measures [76, 77] are informed by the SELYE study [76], literature on implementing school-based curricula [93], and theoretical protective and risk factors for suicide among rural youth [6, 18, 42, 94, 95]. Given our emphasis on feasibility and acceptability of the novel implementation model, we propose fewer distal outcome measures than the original YAM to accommodate participating schools' concerns about the study taking up too much class time.

2.4.1. Instructor Assessment of the Feasibility of YAM-TE versus YAM-EXT. We will ask instructors about their experience both post-training and post-program delivery the following questions on a 5-point Likert scale (strongly disagree to strongly agree): "The YAM training was worth my time" (post-training) and "Teaching the YAM program was worth my time" (post-YAM) [96]. Additionally, we will ask instructors to answer these open-ended questions (3 post-training and 4 post-YAM implementation): "What did you like the most about the YAM training?" "What did you like the least about the YAM training?" "What are your recommendations to improve the YAM training?" "What did you like the most about teaching the YAM program?" "What did you like the least about teaching the YAM program?" "What are your recommendations to improve the YAM program?" "What could be done to better support you in your role as YAM instructor?" [89].

Fidelity will be measured via classroom observation and instructors' self-report, using checklists. Classroom observations will be conducted by trainers during 5 randomly selected YAM sessions per YAM-TE or YAM-EXT. Observers will be a neutral presence in the classroom; they will use the Fidelity Checklist (same as self-report checklist, below) to assess key components of the session as well as rating the quality of implementation. Observers will not provide feedback to instructors at the time of

observation; rather, instructors will receive summary reports upon completion of the study. No youth will be identified on the Fidelity Checklist. After each YAM class, TE and EXT instructors will complete a fidelity self-report checklist, indicating (yes/no) whether core YAM content or activities comprising a session was covered (e.g., session 1: “clearly reviewed symptoms of depression, giving examples for each”). In an open text box next to each checklist item, instructors may comment on student engagement in discussion around the curriculum; how adequately prepared instructors felt to lead the discussion; and whether (and if so why) any topics were not covered. On a standard form, instructors will record any changes made to key components during sessions and any issues or barriers they experienced implementing session content. Self-assessments should take no more than five minutes/YAM session to complete.

2.4.2. Youth Assessments of the Acceptability of YAM-TE versus YAM-EXT. Upon completing the YAM program, youth will be asked to rate six items (using a 5-point Likert scale), asking whether they thought YAM was helpful; added to their understanding of mental health; enhanced their knowledge and skills; was respectful of their cultural background; whether they trusted the instructor; and whether the instructor was skilled at teaching YAM. Via two open-ended questions, youth will be asked to report two things they liked about YAM and what, if anything, they would change about the program.

2.4.3. Youth Demographic Characteristics, Assessments of Outcomes. Youth will complete baseline, post-YAM (outcomes/mediators only), and 12-month assessments in a computer lab or using iPads during health class. Based on pilot work, we expect youth assessments to take about 30 minutes.

Demographic Questionnaire. Youth will be asked to report age; sex (male, female, nonbinary); race/ethnicity, receipt of free school lunch during the current school year, and a question concerning family food insecurity adapted from the USDA Food Security Survey Model [97] (“In the previous 12 months was there any time your family has run out of food and not been able to purchase more?”). We will use Goodman et al.’s adaptation of the “MacArthur ladders” to assess socioeconomic status. The

MacArthur ladders have been found to be reliable across culturally diverse samples of children [98]. Youth indicate “at this time,” on which rung of the pictorial 10-rung ladder they believe their family stands relative to other families in the US society (*subjective SES*). Anchor points are provided at 10 (“at the top are the people who are the best off-- have the most money, the highest amount of schooling; and the jobs that bring the most respect”) and at 1 (“at the bottom are the people who are the worst off—they have the least money, little or no education, and no job or the jobs that no one respects”) [99, 100]. To measure perceived social status among their school peers, students will be presented with another ladder (“Now assume that the ladder is a way of picturing your school”) and asked to place themselves relative to other students. Rung 10 represents “the people in your school with the most respect, the highest grades, and the highest standing,” and rung 1 represents “the people no one respects, no one wants to hang around with, and have the worst grades.” In a large adolescent community sample, each of the ladders and the ladders combined explained about 10% of unique variance of adolescents’ depression scores [99].

Depression and suicidal behaviors. Three standardized Youth Risk Behavior Survey questions (response choices: yes/no) will be included: “During the past 12 months, did you ever feel so sad and hopeless almost every day for two weeks or more in a row, that you stopped doing some usual activities?”; “Have you ever seriously thought about killing yourself?”; “Have you ever tried to kill yourself?” [101].

Psychological risk factors for youth suicide, behavioral health problems, and impairment. We will use 8 items of the Interpersonal Needs Questionnaire [102] to measure Thwarted Belongingness (e.g., “These days, I feel like I belong”) and Perceived Burdensomeness (e.g., “These days, I feel like a burden on the people in my life”), each rated on a 4-point scale (1 = Not at all true for me to 4 = Very true for me). We will use the 25-item Strengths and Difficulties Questionnaire (SDQ) [103] to measure emotional symptoms, conduct problems, hyperactivity and/or inattention, peer relationship problems

and pro-social behavior. The SDQ has been validated extensively [104] and was used in the YAM trial [75, 105]. We will measure past-12-month impairment due to a mental (item 1) or alcohol/drug (item 2) problem; sleep disturbance using 4 items from the PROMIS Pediatric Disturbances Item Bank, which was validated for youth ages 8 to 17 years [106]; and subjective well-being using the 5-item WHO Well-being Scale (WHO-5) (0 = worst possible to 5 = best possible quality of life) and has been shown to provide reliable assessment of adolescents' subjective well-being [77, 107, 108]. We will use the 4-item subscales "Cognitive Decision Making" (e.g., "You thought about what would happen before you decided what to do"), "Direct Problem Solving" (e.g., "You tried to make things better by changing what you did"), "Control" (e.g., "You told yourself you could handle whatever happens"), and "Optimism" (e.g., "You told yourself that things would get better") of the Children's Coping Strategies Checklist – Revised (CCSC-R) [109, 110]. Youth will be asked to rate how often they usually use a strategy to solve their problems or make themselves feel better within the past month on a 4-point scale (1 = Never to 4 = Most of the time). The CCSC-R has been used to assess coping behaviors in youth ages 9-15 years from various demographic backgrounds and participating in youth mental health interventions [52, 111].

Mental health literacy, help seeking confidence and behaviors. We will use 7 items from the Depression Knowledge Test [112] to measure students' knowledge acquisition related to core content of YAM and one open-ended question about knowledge of local mental health resources. We will assess youth's confidence to seek help, using a 5-point Likert scale (1 = Not confident at all to 5 = Very confident), asking "How confident are you to seek help if you had a) an alcohol or drug problem, b) depression, anxiety, or another emotional problem, and c) thoughts about killing yourself?" [113]. We will ask 3 questions about help seeking (yes/no): "In the past 12 months, have you talked to a medical doctor or other professional (psychologists, counselors, nurse, other healing professionals) about a) problems with feeling depressed or anxious problems, b) drinking alcohol or taking drugs, or c) thinking about killing yourself or having made an attempt to kill yourself?"

2.5. Data Analysis Plan

2.5.1. Preliminary Data Evaluation. Prior to analysis, the data will be audited for quality and completeness, including missing data patterns and evaluation of distributions. The equivalence of the random assignment of groups will be assessed by comparison of intervention groups on demographic and clinical characteristics. Should groups differ on any characteristics, these variables will be used as covariates in the analyses.

2.5.2. Analysis of Primary Hypotheses. To date, there have been no RCT studies evaluating the use of TE instructors to deliver the YAM program. Hence, there is no historical evidence for determining a noninferiority margin (M1) to test the hypothesis that the YAM-TE does not differ from the standard YAM-EXT regarding fidelity (teachers) and acceptability (teachers and youth). In the absence of statistical evidence, we will use Cohen's [114] recommendations for a moderate effect size to define M1. For quantitative outcomes, M1 will be Cohen's $d = 0.5$ (YAM-TE performs worse than YAM-EXT), and for binary outcomes, M1 will be relative risk (RR) = 1.90 (YAM-TE performs worse than YAM-EXT). The results of these pilot study analyses will inform the development of a statistically informed M1 for the YAM-TE compared to YAM-EXT in a future fully powered noninferiority trial.

Linear (continuous outcomes) and logistic (binary outcomes) regression analyses will be used to test hypotheses for teacher outcomes. Separate regression models will be tested to estimate unadjusted intervention effects and intervention effects adjusted for potential confounding variables (e.g., sex). Parameter estimates from these analyses will be used to calculate effect sizes and 95% confidence intervals for the difference between the YAM-TE and YAM-EXT groups. If the 95% confidence interval for the effect size exceeds M1, that is, the effect size for the inferiority of the YAM-TE relative to the YAM-EXT is greater than Cohen's $d=0.5$ or $RR=1.90$, this would suggest that the YAM-TE is inferior to the YAM-EXT, and we cannot reject the null hypothesis that the YAM-TE does not differ from the YAM-EXT on the outcomes.

Mixed linear and logistic regression analysis will be used to test hypotheses for youth outcomes, adjusting for clustering of students within teacher/trainer. Separate regression models for post-intervention student acceptability will be tested to estimate unadjusted intervention effects and intervention effects adjusted for potential confounding variables (e.g., gender, ethnicity). Models evaluating other student outcomes will adjust for pre-intervention variables, in addition to potential confounding variables (e.g., sex, ethnicity). The parameter estimates from these analyses will be used to calculate effect sizes and 95% confidence intervals for the difference between the YAM-TE and YAM-ETX groups. If the 95% confidence interval for the effect size exceeds the non-inferiority margin, that is, the effect size for the inferiority of the YAM-TE relative to the YAM-EXT is greater than Cohen's $d=0.5$ or $RR=1.90$, this would suggest that the YAM-TE is inferior to the YAM-EXT, and we cannot reject the null hypothesis that the YAM-TE does not differ from the YAM-EXT.

Exploratory analyses will include testing moderation of the intervention effect by potential modifier variables (e.g., sex, family poverty). Hierarchical mixed models will be used to test the mediating effect of mental health literacy, belongingness, and perceived burdensomeness on the intervention effect. Additional exploratory analyses may involve incorporating teacher/trainer outcomes in the mixed models as predictors of youth outcomes, as well as teacher/trainer outcomes, by intervention group interactions to evaluate the potential moderating effect of teacher/trainer characteristics on intervention group differences in student outcomes.

2.6. Ethical Considerations

The study will not commence until approved by the Institutional Review Board (IRB) of the participating university and by the local school district's superintendent office. A draft IRB protocol is provided in Supplement A. Past studies have shown that asking about suicide does not increase risk for self-harm [115, 116]; and the two questions we will ask student are taken from a widely-used youth

1 suicide risk assessment tool already given to students in the four participating schools [11]. Safety will
2 be measured by TE and EXT instructors' completion of an adverse event checklist after each YAM class.

3 **3. DISCUSSION**

4 We expect our study to expand the science of youth suicide prevention by targeting an as-yet
5 under-served study population, rural youth, and evaluating a teaching model that preserves the goal of
6 providing YAM by instructional staff unfamiliar to the students, yet that may be superior regarding
7 sustainability for resource-strapped rural communities (YAM-TE). Our study is designed to collect
8 feasibility and acceptability data concerning all aspects of the prevention trial: program delivery format,
9 recruitment, and assessment strategies and measures. It also will generate pilot data concerning
10 proximal (end of program) and distal outcomes.

11 3.1. Limitations and Future Directions

12 Several limitations warrant consideration. One, the YAM curriculum is designed to engage all
13 youth in a classroom to share their perspective or provide specific examples of challenges they
14 encounter in their daily lives. As such, the proposed study will not endeavor to create separate
15 adaptations by ethnic group, but rather will maintain YAM's universal prevention approach. That said,
16 for interventions in states such as MT, we believe that developing and testing a cultural adaptation of
17 YAM for implementation in Native American reservation schools represents an important goal but
18 exceeds the scope of our study and warrants being the focus of a separate study. Related, in US states
19 with other ethnic or racial minorities (e.g., African American youth or Latinx youth), studies are needed
20 to examine the cultural appropriateness and efficacy of YAM. Two, the TE delivery model is envisioned
21 to work in communities where neighboring schools are located close enough for exchanging teachers
22 without undue time burdens of transportation costs. For geographically more isolated schools, the
23 standard EXT model may still be the better option; alternatively, in states with land-grant universities,
24 the Extension model may be a sustainable option. Three, generalizability of findings will depend in part

1 on robust student participation. We believe that the feasibility study approach is invaluable for
2 gathering information about optimizing strategies for securing parental consent and student assent.
3 While the proposed study will be carried out in one rural US state (MT), if proven feasible and based on
4 pilot data promising to be effective, we believe the YAM-TE model can be applied in other US states and
5 may ultimately offer a model for other countries.

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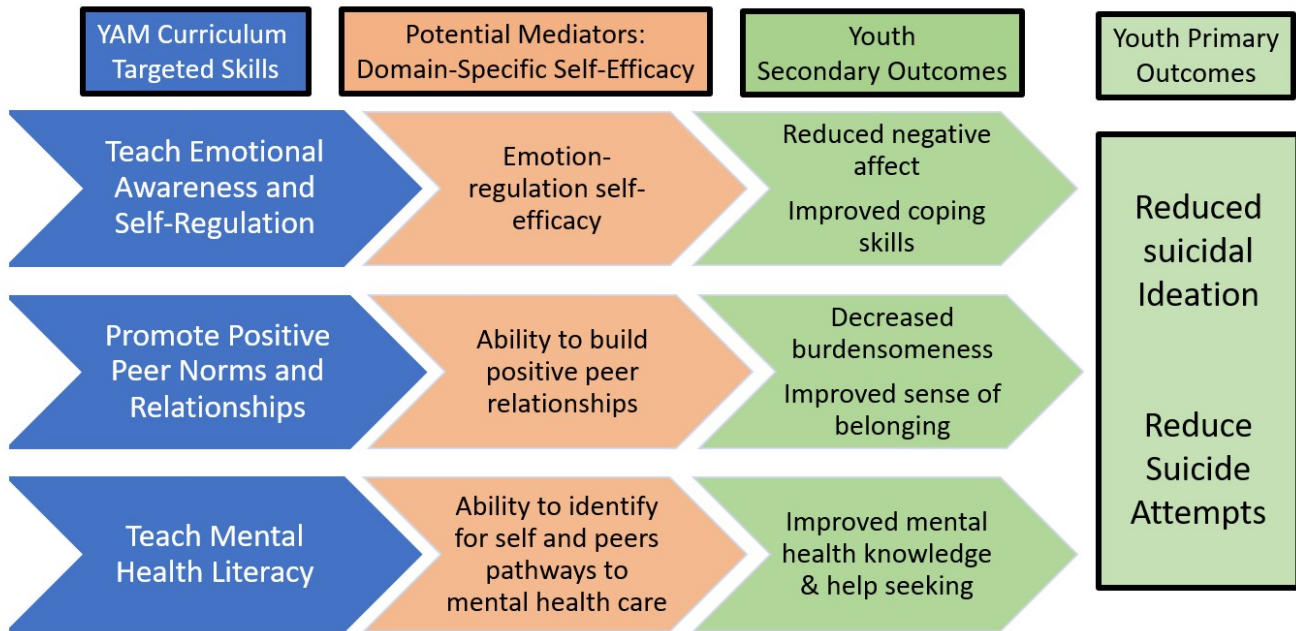


Figure 1. Model of Action: From skills-building curricular targets to positive youth outcomes

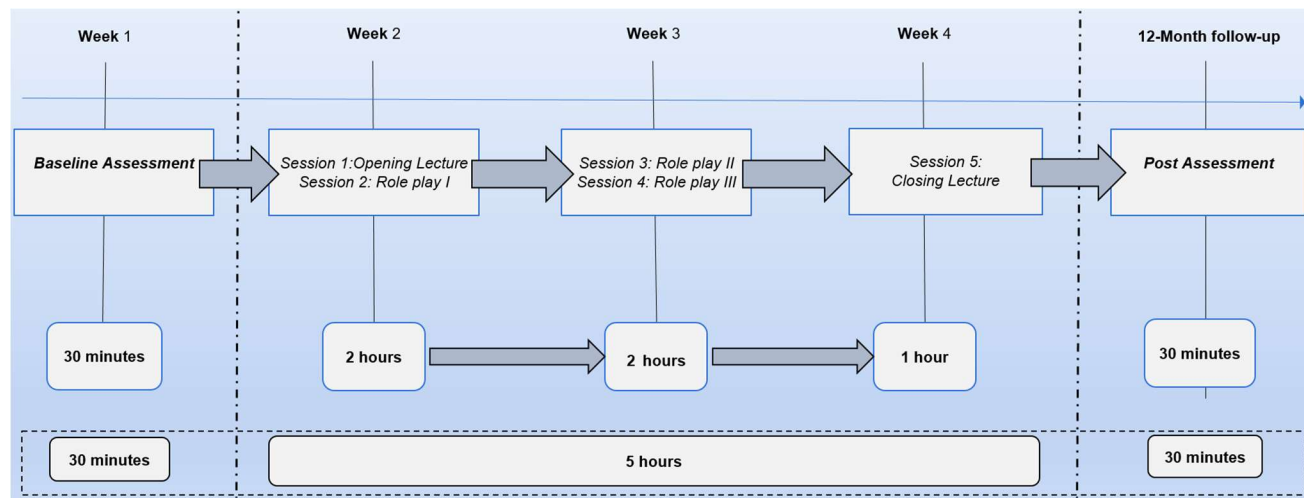


Figure 2: Timeline of program delivery and youth assessments

Youth Aware of Mental Health (YAM) Program Sessions

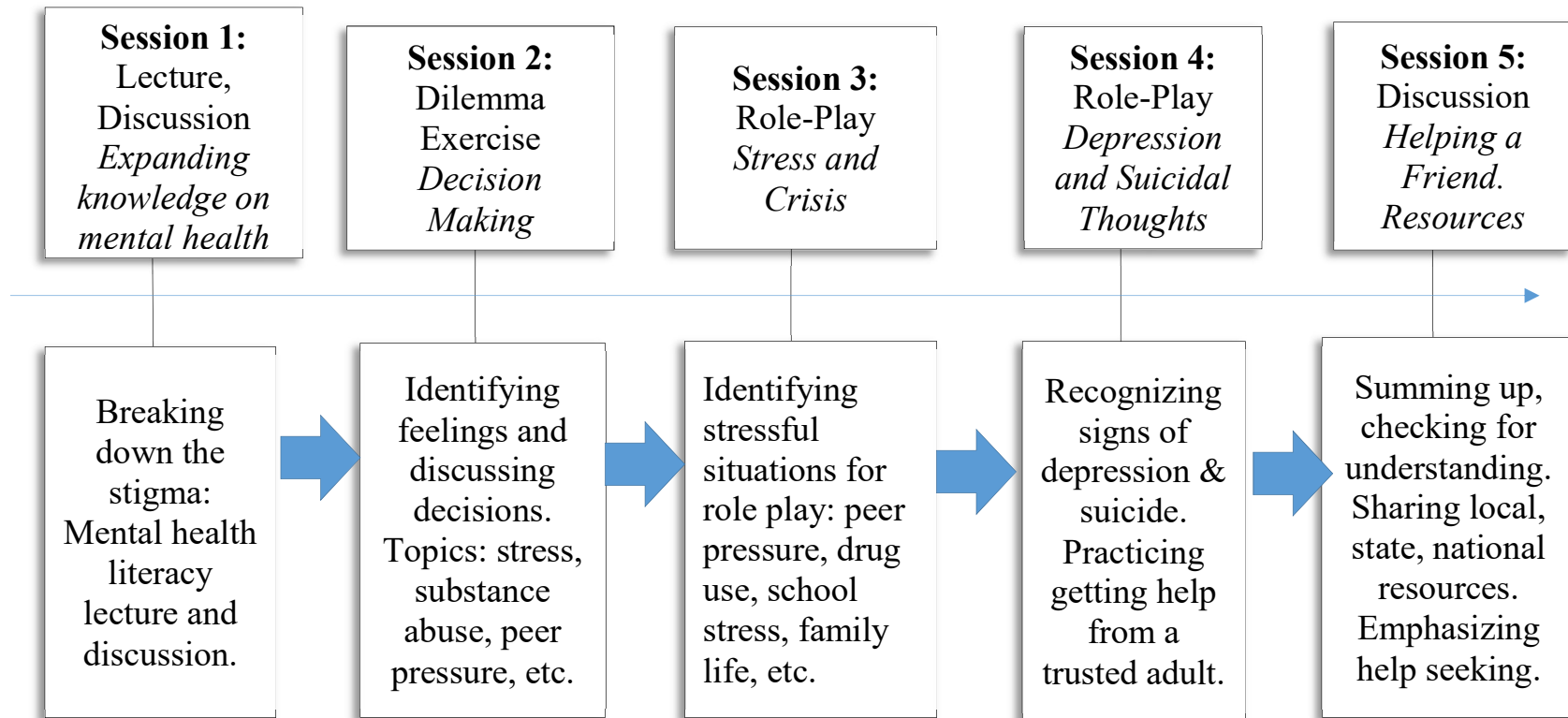


Figure 3: YAM Session Content and Primary Teaching Mode