

ORIGINAL ARTICLE

SUICIDE PREVENTION AS A COMMUNITY DEVELOPMENT PROCESS: UNDERSTANDING CIRCUMPOLAR YOUTH SUICIDE PREVENTION THROUGH COMMUNITY LEVEL OUTCOMES

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ABSTRACT

Objectives. Community-based models have become increasingly prominent in prevention, and have special relevance for suicide prevention in circumpolar Indigenous communities. It follows that outcomes from circumpolar suicide prevention programs might be more completely understood at the community level. We present here a methodology for analysis at this level. This paper seeks to understand a cultural prevention program for rural Yup'ik youth in Alaska targeting suicide and co-occurring alcohol abuse as a community development process through changes at the community level.

Study Design. Quasi-experimental design with assessment at pre- and post-intervention or at 4 time points. The community development process for this project began in October 2004. The first program baseline assessment began in November 2006, prior to prevention activities with youth and parents, and the post-intervention assessment concluded in March 2008.

Methods. Five key informants pre- and post-intervention completed a community readiness assessment, which is a structured procedure assessing a community's awareness of suicide as an issue and its organizational readiness for prevention programming. Forty-three adult caregivers or sponsors of youth in the prevention program completed an assessment of behaviours that contributed to community protective factors from youth suicide and alcohol abuse at 4 time points before, during and after the intervention. The 54 youth who participated in the prevention program completed an assessment of community protective factors, also at 4 time points before, during and after the intervention. The community protective factors

from suicide that were assessed included safety, enforcement of alcohol prohibitions, role models, support and opportunities for youth.

Results. Community readiness for the prevention efforts increased to new developmental stages of readiness post-intervention, and a trend in the data suggested community protective factors increased in the amount of protective behaviours performed by adults (slope estimate=0.0162, 95% CI-0.0028–0.0351, $d=.55$) and in the perceptions of youth (slope estimate=0.0148, 95% CI-0.0004–0.0291, $d=.45$), in a dose response relationship to the number of prevention program sessions attended by adults and youth.

Conclusions. Using data from a feasibility study, this paper demonstrates the feasibility and potential utility of methodological approaches that use community-level variables beyond individual level outcomes in circumpolar suicide prevention research.

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Keywords: Suicide, suicide prevention, Alaska Native, community readiness assessment, community-based participatory research

INTRODUCTION

Community-based models that seek to increase community participation and local capacity have become increasingly prominent health promotion and prevention program approaches (1). One focus of this *IJCH* special issue on suicide in the circumpolar areas is on methodology for examining/monitoring suicidal behaviour in the Arctic areas. In this paper, we describe a community-level methodological approach to examining outcomes of community-based circumpolar suicide prevention programs. We then provide an example of use of this methodological approach with data from a feasibility study of a community-based prevention program targeting suicide and alcohol abuse among Yup'ik youth living in a remote community in rural Alaska.

The unit of analysis in prevention research has been a hotly debated topic with a long

tradition in the research calling for community-level measurements of outcomes (1,2). Evaluation of the workings and effectiveness of circumpolar suicide prevention programs can be improved by using recent systems sciences approaches (3), whose far-reaching recommendations refocus the analysis to include community-level outcomes over individual-level variables.

This type of refocusing on different levels of outcomes has great urgency in youth suicide prevention programs. The base rate of suicide deaths as a prevention target in these programs is so low that they defy statistical modelling and the period of vulnerability in young adulthood stretches over a decade. In remote circumpolar communities that are characterized by extended kinship relationship structures and small populations, this refocusing is especially pertinent. Small geographically dispersed populations lead to small sample

sizes that do not permit adequate statistical power, particularly given the low base rate of suicide. Additionally, among Alaska Native youth, a recent path analytic study suggested community level influences exert greater impact on reasons for life than individual level characteristics do, while family influences impacted reasons for life outcomes indirectly through their impact on attitudes towards alcohol use and abuse, as mediated by youths' peer relationships (5). Finally, tribal communities are collective in nature, and individual level models often lack the capacity to develop collective community-level interventions (6,7).

This paper is a response to recent calls in the methodological literature for ecologically based assessments in prevention work with Indigenous youth populations (8). Its purpose is to understand a cultural prevention program for Yup'ik youth in Alaska as a community-development process by using a methodological approach that focused on an analysis of outcomes at the community level. In order to explore changes at the community level, we evaluated changes in community readiness to engage in suicide and alcohol prevention activities and to build protective factors for youth. Community readiness assessment (CRA) has an extensive history of use in prevention programs (9) and in Indigenous communities (10). CRA evaluates the developmental trajectory of a community's response to an issue using a theory of change model that begins with early awareness of the issue and progresses through stages of organizational response. We also assessed caregivers' efforts to build community-level protective factors for youth, and youth perceptions of community climate regarding protective supports and opportunities for them. This is in contrast to measurement strategies that focus on change at

the individual level through such variables as a decrease in youth suicidal ideation. We examine impact on community readiness assessments, and youth and adult reports of community-level protective factors, as outcome variables of our suicide and alcohol abuse prevention efforts. These variables were identified in a heuristic model of protective factors developed through a program of qualitative research with Alaska Natives (11,12), which were subsequently tested through structural equation modelling with Alaska Native youth (5).

MATERIAL AND METHODS

Setting

The suicide prevention program reported in this study was conducted in a remote Yup'ik community in south-western Alaska. The University of Alaska Fairbanks Institutional Review Board and the Yukon-Kuskokwim Health Corporation Human Studies Committee approved this research. All adult participants gave informed consent before participation in the study, and all youth participants gave assent following their parents' consent.

The geographic setting of this community is off the road system, accessible only by boat, small plane or snowmobile, and has a population of approximately 650. The community ethnicity is over 90% Yup'ik. Elders speak Yup'ik as a first language, but youth speak English as their first or only language. A mixed subsistence economy is augmented by a limited number of jobs in the tribal, state and federal government, in health care and in the local school district. Given the high costs of transportation for food, the population's diet is heavily dependent on local fish, birds and land and marine mammals.

The recent dramatic increases in fuel prices and a serious decline in salmon populations have placed economic stress on this community, which is situated within 1 of the 10 lowest per capita income counties in the United States (13). However, an enduring strength and asset of this community is its identification and pride in its cultural heritage and identity, which provided important motivation for the cultural focus of the intervention described in this study. In contrast to the reservation system elsewhere in the United States, most remote Alaska Native communities, including the setting of this study, are federally recognized tribal entities, and many residents are shareholders in regional Alaska Native Corporations that also operate regional health corporations providing medical care for tribal members. In 2004, Alaska experienced 155 suicides, the highest rate in the United States (14). In contrast to the U.S. general population suicide incidence rate of 11/100,000, data from 2004–2006 indicate that the suicide incidence rate in Alaska was 23.4/100,000, with 28% in the 20–29 age group and 39% being Alaska Native (though they comprise only 16% of the population). The Yukon-Kuskokwim Delta region, in which this community is situated and which is over 90% Yup'ik, experienced an incidence rate of 61.3/100,000 during 2004–2006, representing the greatest number of Alaska Native suicides in the state (14).

Participants

Key Informants

Two waves of key informants participated in the community readiness assessment (CRA) described below. Key informants were selected to represent as many different segments of the community as possible. At pre-intervention, the

3 key informants consisted of 1 school, 1 tribal, and 1 city government leader. Two additional Elder interviews that were conducted could not be scored using the CRA handbook scoring criteria (15) and are not reported. Spradley (16) describes key informant methodology as requiring individuals who can yield rich data on a particular domain. The domain of interest in this case was suicide and alcohol abuse in the community, and the 2 interviewees we ultimately dropped from analyses were unable to provide data on this domain. At post-intervention, 5 key informants were interviewed: 1 school leader, 3 tribal and city leaders, and 1 Elder. Three of these were the same people as in the first CRA interview. Consistent with the experience of other CRA researchers (17), we found assessing a few informants (e.g., 3–6 informants) was adequate for these small communities to “provide accurate information” (17, p. 832).

Youth

Sixty-one youth were recruited to participate in *Elluam Tungiinun* (Toward Wellness) prevention program from the approximately 100 12–17 year olds residing in the community. Sixty of these youth completed wave 1 assessments; 46 completed wave 2; 43, wave 3; and 61, wave 4. This resulted in 37 youth who completed all 4 assessment waves (T1–T4), 8 completed 3, and 10 completed 2. We identified multivariate outliers using hierarchical cluster analysis, a statistical method that detects homogenous clusters of cases by grouping cases together based on an iterative distance computation. Using this approach, we identified 1 multivariate outlier, a youth who was distant from others across the measures. In addition, the 5 youth who completed only the final assessment

were dropped from the analysis, resulting in 54 participants. All youth were Yup'ik. Youth demographic data are presented in Table I.

Adults

Parents or an adult sponsor were recruited for each youth who participated in the *Elluam Tungiinun* prevention program. Forty-seven adults were recruited; some families had more than 1 child in the intervention. Forty-six adults completed wave 1 assessment; 31,

wave 2; 26, wave 3; and 44 completed wave 4. This resulted in 22 adults who completed all 4 waves (T1-T4); 4 who completed 3; and 16 who completed 2; There were 5 adults who completed 1 assessment and 4 who completed 2 assessments but did not attend intervention sessions and who were dropped from the analysis, resulting in 43 adult participants. All adults were Yup'ik, except for 1 parent who identified as white. Adult demographic data are presented in Table II.

Table I. Demographic characteristics of youth participating in the prevention program.

Gender	
Male	23
Female	32
Age	
M	14.29
SD	1.75
Grade	
7	24.5%
8	30.2%
9	17.0%
10	9.4%
11	9.4%
12	9.4%
Parental marital status	
Married	33.3%
Single	61.8%
Divorced	3.6%
Adults living at home	
Mother	76.4%
Father	65.5%
Grandparent	23.6%
Other relative	14.5%

Table II. Demographic characteristics of adults participating in the prevention program.

Gender	
Male	13
Female	30
Age	
Mean	48.09
SD	12.73
Education	
No high school	26.2%
Some high school	16.7%
High school degree	35.7%
Some college	14.3%
College degree	7.1%
Marital status	
Married	30.2%
Single	65.1%
Divorced	4.7%
Occupation^a	
Subsistence	34.9%
Time Limited Grand Project Work	7.0%
Tribal Government	11.6%
State or Federal Government	2.3%
Business	9.3%
Homemaker	25.6%
School	18.6%
Other Occupation	39.5%

^a Respondents could indicate more than one occupation; therefore, the percentages equal more the 100%.

Measures

Community readiness assessment

As part of the community-based participatory research collaboration between the community and UAF researchers, CRA was conducted (15) at pre- and post-intervention, approximately 1 year apart. In the current study, CRA over time provides both an assessment of change in community climate and an evaluation of community mobilization regarding suicide as a problem. CRA evaluates 6 dimensions of community readiness described in Table III.

CRA is conducted using key informant interview procedures described in Oetting et al (17). The CRA interview is formatted in a general way to allow adaptation of the interview to fit the community issues at hand.

The issue in this community was suicide and alcohol abuse that the community understood as a co-occurring problem. In response to community cultural expert feedback and our previous work using CRA in rural Alaska, we culturally and linguistically adapted specific wording of the interview protocol for use in rural Yup'ik communities. This adaptation work used focus-group methodology. The focus groups were comprised of local community experts who revised the wording of interview questions and shortened the interview length. The goal of this adaptation of the interview was to preserve identical meaning of the questions while enhancing local understandability, comfort level and cultural appropriateness. This interview protocol can be found in Table IV.

Table III. Dimensions of community readiness assessment (15).

Dimension A	Community efforts: To what extent are there efforts, programs and policies that address the issue?
Dimension B	Community knowledge of the efforts: To what extent do community members know about local efforts and their effectiveness and are the efforts accessible to all segments of the community?
Dimension C	Leadership: To what extent are appointed leaders and influential community members supportive of the issue?
Dimension D	Community climate: What is the prevailing attitude of the community towards the issue?
Dimension E	Community knowledge about the issue: To what extent do community members know about the causes of the problem, consequences and how it impacts the community?
Dimension F	Resources related to the issue: To what extent are local resources – people, time, money, space — available to support efforts?

Table IV. Community readiness assessment key informant interview protocol for suicide and alcohol abuse.

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1. Using a scale from 1 to 10, how much of a concern is alcohol abuse among 12–18-year-olds and suicide in your community? (With 1 being “not at all” and 10 being “a very great concern.”) (B)*
 2. What alcohol abuse and suicide prevention programs or services for 12–18-year-olds are available in your community and schools? (A)
 3. What does the community know about these efforts? (B)
 4. What are the strengths of these prevention programs and services? (B)
 5. What are the weaknesses of these prevention programs and services? (B)
 6. How long have these efforts been going on in your community? (A)
 7. Can you describe any planning in your community for youth alcohol abuse and suicide prevention programs or services? (A)
 8. Can you describe efforts to include youth in the planning of prevention programs or services in your community? (A)
 9. Using a scale from 1 to 10, how concerned are your leaders with providing alcohol abuse and suicide prevention services for 12–18 year olds in your community? (With 1 being “not at all” and 10 being “a very great concern.”) (C)
 10. How are these leaders involved in efforts regarding youth prevention efforts in your community? (C)
 11. Would the leadership support additional efforts to address youth prevention planning in your community? (C)
 12. What is the community’s attitude about alcohol abuse and suicide prevention among 12–18-year-olds? How does the community support the efforts? (D)
 13. What are the primary obstacles to obtaining or adding more prevention programs or services in your community? (D)
 14. How knowledgeable are community members about these issues? (E)
 15. In your community, what type of information is available about alcohol abuse and suicide prevention among 12–18-year-olds (E)
 16. Is local data on Native alcohol abuse and suicide among 12–18-year-olds available in your community? If so, from where? (E)
 17. Who would a youth turn to first for help if he/she was thinking about abusing alcohol or hurting her/himself? (F)
 18. What is the community’s attitude about getting involved (e.g., volunteering time, financial donations, providing space) in the prevention efforts? (F)
 19. Are you aware of any action plans or proposals to address this issue in your community? (F)
 20. Do you know if any of these prevention activities are being evaluated? (If yes, on a scale of 1 to 10, how far along is the evaluation effort; with 1 begin “not at all” and 10 being “very far along”?) (F)
 21. Lastly, do you have any additional comments that you would like to share?
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* Letter in parentheses indicates the community readiness dimension the question taps (see Table III).

A masters degree psychologist who had experience working in the community conducted all the CRA interviews. It was crucial to involve a person who was known and trusted by the community in order to access the interviewees. Furthermore, his/her involvement contributed to the richness, candour and depth of the data collected about the sensitive topics of suicide and alcohol abuse. Verbatim transcripts of key informant responses to the interview questions were read by the assessment raters who assigned a score from 1 to 9 for each readiness dimension using rating criteria from the CRA manual and the CRA consensus scoring method. All raters agreed upon a final score after independently scoring the interview (15). Rating scores indicate the stage of readiness for each dimension, summarized in Table V. The PhD-level psychologist who directed the cultural and linguistic adaptation also supervised the CRA scoring. Scores at pre-intervention are the consensus scores of this psychologist, the MA-level psychologist who conducted the interviews, and a second PhD-level psychologist with significant CRA experience in rural Alaska. Scoring at post-

intervention was consensus scoring of the second Ph.D-level psychologist and the MA-level psychologist.

Adults

Community Protective Factors Behaviours.

The Adult Community Protective Factors Behaviours Scale was adapted from the People Awakening Yup'ik Protective Factors Scale (11). The People Awakening Yup'ik Protective Factors Scale was developed from qualitative life history interviews that identified protective factors for Alaska Natives. The scale asked respondents to rate the presence and importance in their lives of the protective factors found at the individual, family and community levels. In our adaptation of the scale, the Adult Community Protective Factors Behaviours Scale instead tapped behaviours that parents engaged in to foster and enhance these community-level protective factors for young people in the community that were identified in our earlier research (11,12). This 12-item scale is comprised of support, opportunities, limits and safety, and role model subscales. Administered across the intervention, the scale

Table V. Stages of community readiness.

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1. No awareness: issue not recognized as a problem
 2. Denial / resistance: issue recognized but not as occurring locally
 3. Vague awareness: local concern recognized, but no immediate motivation to confront
 4. Preplanning: recognition of concern but efforts unfocused
 5. Preparation: active planning and modest community support
 6. Initiation: effort justified by community and activities underway
 7. Stabilization: activities supported by leadership with trained and experienced staff
 8. Confirmation/expansion: efforts in place, community supports expansion, local evaluation
 9. High level of community ownership: sophisticated knowledge, evaluation, application of model to other issues
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provides a measure of the adults' behaviour, in response to their participation in the prevention program, that directly contributes to community-level protective factors (in contrast to individual or family-level protective factors). In this way, it provides a direct measure of a community-level variable. We administered the scale only to those adults who participated in the prevention program with their own child or with the youth they sponsored because we were interested in direct impact of the program on community-level outcomes. Responses are on a 5-point Likert scale from 1 (not at all) to 5 (a lot), yielding a range of possible scores from 12 to 60. We used initial scores on the support subscale as a measure of pre-existing adult protective factor behaviours on the individual level, allowing us to control for pre-existing individual differences in protective behaviour. Adults were given the choice of using a Web-based computerized administration survey or a paper and pencil survey. Fifteen adults chose to use paper and pencil.

Youth

Community Protective Factors. The Youth Community Protective Factors Scale consists of 7 items adapted from the support and opportunities subscales of the People Awakening Yup'ik Protective Factors Scale, rated using a Likert rating scale identical to the adult measure, which yielded a range of possible scores from 7 to 35. The PA Yup'ik Protective Factors Scale was an adult scale, some of whose questions asked about the participants' protective factors in their youth. The Youth Community Protective Factors Scale adapted these items for

youth who rated protective factors as they applied to the present time. The scale taps youth perceptions of the extent of community support and opportunities for young people as protective factors. We used initial scores on the support subscale as a measure of pre-existing protective factors at the individual level of each youth. In response to an expressed preference by youth for computer-based surveys in our pilot work, all youth completed the survey using the Web-based computerized version.

Elluam Tungiinun Suicide Prevention Program Procedures

The *Elluam Tungiinun* prevention program was developed by a local community planning group (CPG) and university researchers to build 13 protective factors identified through our earlier research (11,12) on youth, families, and communities, using a community-based participatory research framework. The intervention targeted 2 community-identified ultimate prevention goals: the prevention of suicide and alcohol abuse among youth. Activities were developed by the CPG and compiled in the *Qungasvik* (18), which is a toolbox that communities can draw on in designing modules. The *Qungasvik* is not a prescriptive intervention manual, but instead lays out a process for adapting each activity to reflect local customs and circumstances, the current season and the advice of Elders and other community members. This community-based intervention process becomes the replicable prevention program that is the focus of our ongoing research. Our community co-researchers observed that this adaptation process results in greater community ownership and intervention, as

well as an intervention process that is more ecologically representative of the local characteristics of each of the remote and distinct communities in the region.

Activities were delivered in 1 or more sessions. Each session required 1 to 3 hours. A community-level module, *Qasgiq*, introduced youth and re-oriented the community to the *Qasgiq* which, among other important functions, was traditionally a place of learning. When appropriate, module activities began in the sacred *Qasgiq* circle, designating the activity as a time of respect and learning. This type of setting permitted Elders to orient youth and families to the deeper meaning of each activity. For example, in *Murilkelluku Cikuq* (Watch the Ice), youth travel out on the river ice with their families. Elder experts teach them how to monitor the safety of the ice using visual cues and a tool called an *ayaruk*, a long, steel-tipped staff. A hook at the opposing end of the *ayaruk* allows a person to pull her/himself out of the water if the ice underneath gives way. This activity teaches the protective factor of *ellangneq*, of always being aware, in this case through specific awareness of the changing environment, one's relationship to it and actions in response. Following this activity, the group returned to the *Qasgiq*. Here Elders and parents discussed through personal narratives to discuss the connection of *ellangneq* to the lessons of ice safety, and implications regarding high-risk behaviour and valuing one's own life. In a follow-up session as part of this activity, each youth built her/his own *ayaruk*, which became a symbol of what they learned about *ellangneq* and of protection from suicide. Over the 12

months of the program, 26 prevention activities were delivered in 32 sessions. Seven of the 26 total modules were directed primarily at the community level. However, there were other activities that were part of the community development process that staff engaged in parallel to delivering modules in the *Qungasvik*. For example, staff worked with the tribal council to increase alcohol control, helped develop monthly prayer walks and assisted in facilitation of weekly meetings of the suicide-crisis response team.

Data analysis

To evaluate the intervention effects, we created mixed-effects regression models (19) to account for the clustering of observations within individuals. This method, also known as hierarchical linear modeling (HLM) (20), permitted the use of data from participants who completed 2 or more waves of assessment. The intervention effect of interest (dose) was based on individual participant number of activities attended at each time point and measured increasing levels of exposure to the intervention. The impacts of 3 potential confounding factors were evaluated in the model: pre-existing protection, the amount of time the individual participated in the intervention and the cohort of youth with whom the individual started the intervention.

Pre-existing protection was estimated through scores on the support subscale of the Community Protective Factors Scales for youth and adults at time 1. This accounted for the impact of differences in pre-existing levels of protective factors experienced by the individual. Because entry into intervention started at different times in relation to the

4 assessment times, the data were used to create a slope estimate, and time (measured in days) was centered at each individual participant's start of the intervention to model the effects of length of involvement apart from the intervention dose. We entered terms for cohort because youth tended to begin the intervention in 1 of 3 groups, and adults entered the intervention at 2 different times. Therefore, this term consisted of 2 dummy codes in youth, in which the second group was contrasted with the first group and the third group with the first, and in adults, 1 dummy code compared the first group with the second group. This allowed for the evaluation of the effect of the intervention dose, computed as the number of intervention activities attended, as distinct from time in the intervention, while also controlling for individual variation on a variety of potential confounds. Finally, the interaction of dose by time controlled for the variability in each individual participant's time in the prevention program, as it interacted with the number of activities attended, as separate from the group cohort effect of time of entry into the intervention.

Prior to analysis, multivariate outliers were excluded and all variables were standardized by range (e.g., the minimum was subtracted from each score then divided by the range, expressing each score as a proportion of the range). We used square-root transformations to normalize residual distributions whenever necessary. Models were fit using SPLUS LME (21).

At level 1, the outcome variable at T1–T4 was predicted from an individual intercept, linear time slope, linear dose slope and the interaction between dose and time. At level

2, the level 1 coefficients were predicted by the demographic variables of baseline protective factors (protection) and when the individual became involved in the intervention (cohort). In HLM notation, the model tested for youth¹ can be expressed as:

Level 1 (time):

$$Y_{ij} = B_{0j} + B_{1j}(\text{time}) + B_{2j}(\text{dose}) + B_{3j}(\text{time} * \text{dose}) + e_{ij}$$

Level 2 (individual):

$$B_{0j} = G_{00} + G_{03}(\text{protection}) + G_{04}(\text{cohort 1 vs. 2}) + G_{05}(\text{cohort 3 vs. 1}) + u_{0j}$$

$$B_{1j} = G_{10} + G_{13}(\text{protection}) + G_{14}(\text{cohort 1 vs. 2}) + G_{15}(\text{cohort 3 vs. 1}) + u_{1j}$$

$$B_{2j} = G_{20} + G_{23}(\text{protection}) + G_{24}(\text{cohort 1 vs. 2}) + G_{25}(\text{cohort 3 vs. 1}) + u_{2j}$$

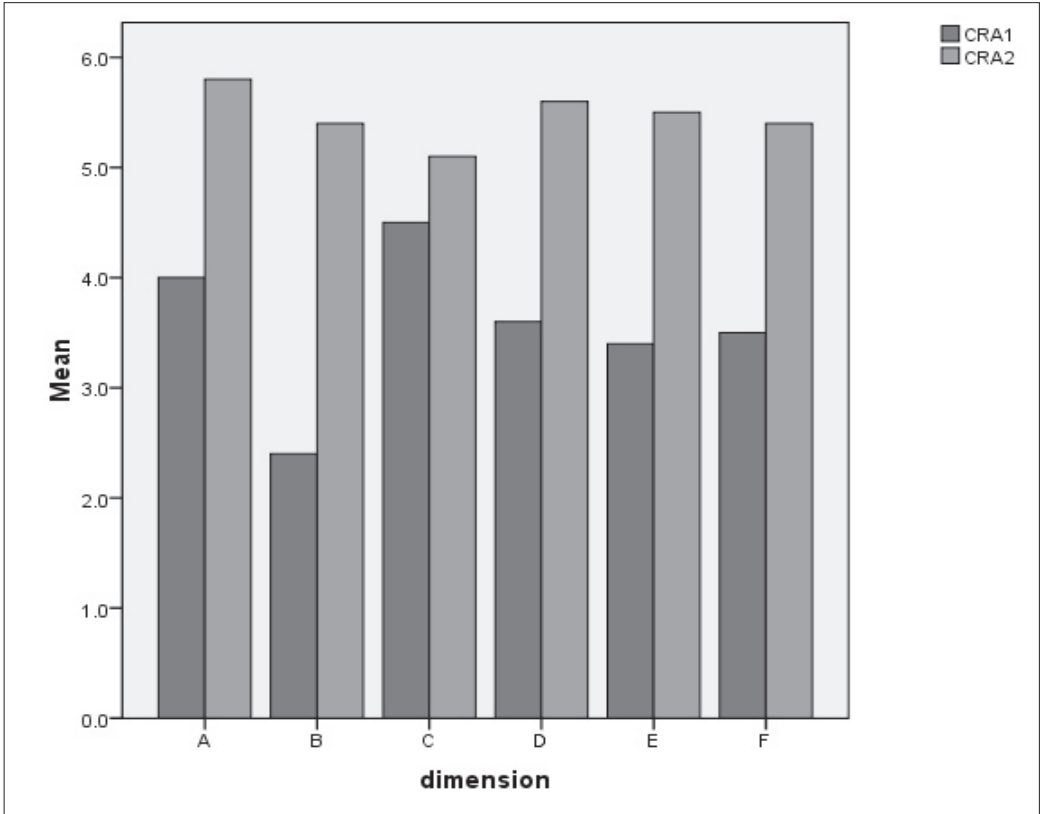
$$B_{3j} = G_{30} + G_{33}(\text{protection}) + G_{34}(\text{cohort 1 vs. 2}) + G_{35}(\text{cohort 3 vs. 1}) + u_{3j}$$

RESULTS

Community Readiness Assessment

Means of the rater consensus scores for teach of the key informants for pre-intervention (CRA1) and post-intervention (CRA2) are presented for each CRA dimension in Figure 1. Overall, total mean community readiness scores across dimensions increased 2 points, from 3.5 to 5.6. Gains were noted in each dimension, with the largest increases in Dimension B, *Community Knowledge* of the problem, and highest scores in Dimension C, *Leadership*.

¹ For adults, because their entrance into the program roughly approximated only 2 cohorts, the G_{x5} term is not included (cohort 3 vs. 1).



Note.

CRA1 = Pre-intervention

CRA2 = Post-intervention

Dimension A = Community efforts

Dimension B = Community knowledge of the efforts

Dimension C = Leadership

Dimension D = Community climate

Dimension E = Community knowledge about the issue

Dimension F = Resources related to the issue

Figure 1. Pre- and post-intervention community readiness assessment (CRA) consensus rating mean scores across key informant interviewees for 6 CRA dimensions.

Adult Community Protective Factors Behaviour and Youth Community Protective Factors
 Mean internal consistency reliabilities for T1 and T2 were $\alpha=.84$ for adult community protective factors behaviour and $\alpha=.74$ for youth community protective factors. Results of the HLM analysis are presented in Table VI. After controlling for cohort effects associated with the 2 different start times of participants within the year-long intervention, outcomes for adult community protective factors behaviour and youth community protective factors are reported for (1) protection, expressed as each individual's pre-existing level of community protective factors at baseline (2); time, expressed as number of days since each individual's intervention start date; and (3) dose, expressed as number of intervention sessions

in which each individual participated. We report slope, standard error, *t* statistic, lower and upper bounds of the 95% confidence interval, and Cohen's *d* as a measure of effect size, which we interpret according to Cohen's criteria for small, medium and large effects (22).

Not surprisingly, pre-existing protection produced slope and medium to large effect sizes in community protective factors for youth and adults, respectively. Time since intervention produced a medium effect size for youth, but a medium negative effect size for adults. However, after partialling out the effects of confounding variables, dose, defined as number of activities attended, produced a slope and moderate effect size in growth of community protective factors in both

Table VI. Hierarchical linear model analysis of adult community protective factors behaviours (n=43) and youth community protective factors (n=54) for protection, time, dose, and time by dose.^a

Outcome variable	Slope estimate	SE	df	t	95% CI Lower	95% CI Upper	p-value	Effect size (Cohen's d)
Adult Community Protective Factors Behaviours								
Protection	0.0975	0.0726	28	1.34	-0.0380	0.2330	0.19	0.49
Time	-0.0003	0.0003	31	-0.89	-0.0009	0.0003	0.38	-0.31
Dose	0.0162	0.0102	31	1.59	-0.0028	0.0351	0.12	0.55
TimeXDose	-0.00002	0.00003	31	-0.58	-0.0001	0.00004	-0.57	-0.21
Youth Community Protective Factors								
Protection	0.1205	0.0411	47	2.93	0.0429	0.1981	0.01	0.79
Time	0.0001	0.0001	70	0.47	-0.0002	0.0003	0.64	0.11
Dose	0.0148	0.0077	70	1.92	0.0004	0.0291	0.06	0.45
TimeXDose	-0.00004	0.00002	70	-1.91	-0.0001	0.000001	0.04	-0.45

^aTo account for 3 waves of youth cohorts participating, the model included a term for cohort 1,2,3. To account for 2 waves of adult cohorts participating, the model included a term for cohort 1,2. To partial out the effects of differing time periods of intervention within each dose effect, the model included an interaction term for Dose X Time. The model is based on data from T2, T3 and T4, as the T1 support subscale comprised the protection moderator in the analysis.

adults and youth across the 4 time points of assessment. The 95% confidence intervals suggest upper and lower limits for the true effects of intervention dose. Although these intervals include zero in both cases, the large amount of the interval lying above zero suggests effects that might have been statistically significant had a larger sample size been possible. Figure 2 displays growth in adult protective factors behaviours and

youth perceptions of community protective factors in response to increasing dose of intervention, expressed as least squares means estimates of range standardized scores adjusted for all the covariates in the model (cohort, protection, time). We also report in Table VI the time by dose interaction, which is interpreted in the conventional manner and which suggests a decreasing level of impact of dose over time.

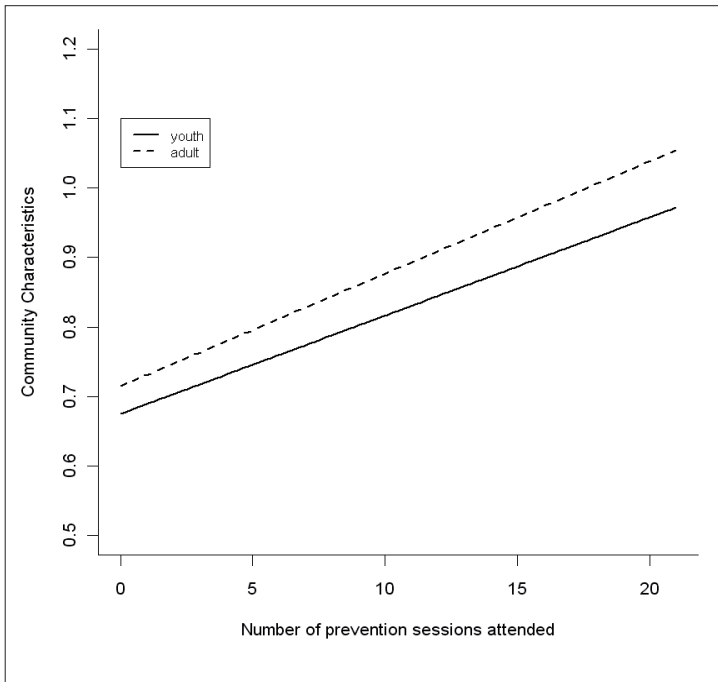


Figure 2. Plot of growth of adult ratings of community protective factors behaviours and youth ratings of community protective factors with increasing number of prevention activity sessions attended, controlling for individual youth's time in intervention, cohort of entry into program and pre-existing level of protective factors.

DISCUSSION

The primary findings of this study suggest that community readiness and community protective factors increased in response to intervention. As an outcome of the *Elluam Tungiinun* prevention intervention, community readiness scores increased in a way suggesting the community had moved to a more advanced stage of readiness regarding programming to address the issue of suicide. Community variables identified in previous research with Alaska Natives (11,12) as protective factors for youth and as protective behaviours for adults also increased by a moderate effect size, in a dose response relationship, to the number of *Elluam Tungiinun* prevention program activities attended. Though the small sample of this feasibility study did not provide sufficient power to obtain statistical significance, the confidence intervals and effect sizes suggest the methodological approach we describe here is feasible to use as part of a larger sample size, full-prevention trial. The aim of this paper was to demonstrate the feasibility and potential utility of this community-level methodology in assessing the outcomes of suicide prevention programs in small, remote, circumpolar communities. Community variables in this study were evaluated by 2 waves of key informants, and 4 assessments of youth and parent self-reports. Results from all data sources converged, providing triangulation of community-level findings through multiple methods and informants.

Overall, community readiness increased by 2 full stages of readiness, advancing from the developmental stage of *Vague Awareness* of the problem, where there is a local concern but limited activities to address the problem, to the stage of *Preparation*, where planning has begun

and there is support for the efforts. The final total score trends to be near the upper end of the range for the *Preparation* stage, suggesting that the community is close to entering the *Initiation* stage, where the community has justified efforts to address the problem and activities are underway. Large gains are noted particularly in Dimension B, *Community Knowledge* of the problem, which increased by 3 full stages of readiness, from *Resistance* to the problem to *Preparation*. Dimension C, *Leadership*, is a particular strength of the community, and is currently at the *Initiation* stage, which describes the community as prepared to implement programs to address youth suicide. The small number of observations in our feasibility study would have resulted in an underpowered analysis, so statistical analysis of the CRA data would not have yielded meaningful results. Therefore, we instead provide a descriptive, qualitative report of outcomes in CRA through movement to more advanced developmental stages of readiness.

However, Slater et al. (23) conducted a large RCT prevention trial using CRA as an outcome. The study, which used an HLM analytic approach, provides a model for how CRA can be used as an outcome in larger prevention trials of suicide-prevention program research. Slater et al. also tested as a fixed effect the impact of post-test interviewees being either repeat interviewees (also interviewed at baseline) or not. The effects of this repeat/non-repeat interviewer variable were non-significant for every one of the 6 community readiness dimensions tests. This suggests that key informant methodology and the CRA scoring system for interviews are able to obtain reliable results when different key informants are interviewed, as long as the new key informant occupies the same domain as the interviewee they are replacing.

Associated variables measured through similar methods using different informant sources (youth and their parents or adult sponsors) showed similar growth in response to participation in the intervention. Our research was interested in changes in adult behaviour in response to the prevention program. The adult scale measured activities that build specific community-level protective factors through behaviors with youth outside the adult's immediate family. These behaviours included activities such as talking to youth about how alcohol can lead to loss of control, providing advice for a young person, providing a youth activity to keep them busy and prevent their boredom, and volunteering for a community youth activity like basketball or outdoor activities. We dropped adults from the analysis who did not attend family-prevention modules because we were interested in whether the intervention affected behaviour that would improve the community environment. The more activities parents attended, the more parents reported growth in their behaviour that provided youth with support, opportunities, limits and safety, and role modelling. Concomitantly, the more prevention activities the youth attended, the more growth youth reported in support and opportunities to them in their community. One way of interpreting these findings is that as parents increased their level of protective factor behaviours, youth responded to these adult behaviours, and perceived growth in these protective factors in their community.

In conducting this study, we also learned the importance of carefully assessing sources of individual and community variations that can affect implementation of community-based interventions and including terms to model such sources of variation in our statis-

tical models. When we found that the length of time individuals were involved and the number of activities they attended were not strongly correlated, we included time and dose in the analyses. Anecdotal reports combined with statistical evidence of substantial individual variation in pre-existing community protective factors led us to include pre-existing protection in the analyses, and anecdotal reports of groups of friends entering the program together at different times led us to examine the distribution of entry dates. When we found evidence for the existence of cohorts, we included terms for cohorts in the analyses.

Two limitations to this study include the statistical power of its design and the lack of direct assessment of the prevention outcome of interest. The small sample size in this feasibility study led to an analysis of prevention program impact with low statistical power. Though the effect sizes reported in this study are quite substantial for prevention outcomes, which typically yield small, not moderate effect sizes, the HLM analyses were only sufficiently powered to detect quite large effect sizes, a magnitude that is unreasonable to expect in universal or selective prevention program outcomes. As the current study's sample size did not allow for meaningful conventional significance testing for a prevention project, to evaluate the strength of these effects, we have included estimates of the confidence intervals, which provide reasonable evidence to support the replicability of these effects. To more fully address this concern, on the basis of these findings, we are currently conducting a 5-year, multisite prevention trial of the *Elluam Tungiinun* intervention to allow adequately powered testing of outcomes on these and other protective factor variables using conventional significance testing.

The community-level outcomes reported here provide no direct assessment of reduction in suicide deaths, or of reduction in suicide risk, typically studied through individual assessment of a variable such as suicidal ideation. We instead assessed growth in variables associated with protection from suicide in past research as evidence of impact. These variables included support and opportunities in the community as perceived by youth, and adult behaviours fostering support and opportunities for youth, including setting limits, creating safe environments in the community and role modelling.

In conclusion, small samples are typical in circumpolar research within small, remote, Arctic communities. In suicide prevention research, this can result in research designs with low statistical power. The low base rate problem associated with suicide death as an outcome variable in circumpolar suicide prevention research compounds the difficulties associated with low-powered designs. At the same time, in one study with Alaska Native youth, community-level variables, in contrast to characteristics of the individual, emerged as the strongest predictor of protection from suicide, and family climate emerged as another important predictor (5). This research report uses data from a feasibility study of an Arctic suicide prevention program to demonstrate the feasibility and potential utility of methodological approaches that study variables beyond the individual level of outcome. This study suggests ways community-level variables in circumpolar suicide prevention research can advance our understanding of suicide and its prevention in the Arctic. As a larger issue, our work stresses the importance of community change in circumpolar Indigenous communities to explain the outcome of prevention activities that address suicide.

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Conflict of interest statement

The authors have no financial or personal relationships with other people or organizations that could potentially influence the results or interpretation of the work being submitted for consideration.

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