




# Implementation evaluation of a pilot project addressing issues at the human–dog interface in a northern indigenous community

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## Results

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## Abstract

In 2020, the Kuujuaq Dog Project (KDP) was operationalized in the Northern Village of Kuujuaq (Québec, Canada) to mitigate issues at the human–dog interface. Differing from previous interventions in its EcoHealth approach, it provided veterinary services, educational components (school workshops and Facebook posts) and strengthened local dog control measures. In 2022, an implementation evaluation assessed its quality of its delivery, differentiation, adaptations and the community's responsiveness. The study followed key principles of the One Health approach and a mixed-methods design, combining a survey of 74 participants and individual interviews with 10 key stakeholders and 25 other community members. Analysis confirmed the relevance of the KDP, highlighting its innovative nature compared to previous dog-related interventions in northern Québec. Awareness of and exposure to the KDP's components varied considerably between veterinary services (89%), Facebook posts (55%) and school workshops (27%). Global exposure to both the veterinary services and educational components was lower among Inuit, men and non-dog owners (not statistically significant). Barriers and facilitators to implementation included long-term engagement of stakeholders and building meaningful partnerships with local stakeholders. Beside supporting the future evolution of the KDP, this study fills knowledge gaps on how to successfully implement integrated, participatory interventions in northern Indigenous communities.

## Introduction

In most arctic and subarctic indigenous Canadian communities, dogs occupy a central place. Such is the case in the Northern Village of Kuujuaq, an Inuit community of nearly 3,000 inhabitants and the largest of Nunavik, the Québec region north of the 55<sup>th</sup> parallel (Lévesque, 2018; Aenishaenslin et al., 2019). Indeed, as historical auxiliaries to the Inuit, dogs contribute to a sense of cultural continuity, an important dimension of indigenous health (Auger, 2016). In other populations, dogs have been associated with multiple benefits for human emotional, physical and social health (Pinello et al., 2022).

However, the village and the other northern communities also face numerous public health problems related to dogs. Dog bites occurrence tend to be higher in these localities than in other Canadian indigenous communities and non-indigenous populations (Daigle et al., 2022). As in the general population, children are especially exposed due to their size and behavior toward dogs, and at a higher risk of fatal wounds from dog attacks (Mediouni et al., 2020; Daigle et al., 2022). Additionally, the proximity to wildlife (e.g., wolves and foxes) increases the risk of transmission of zoonotic pathogens to dogs and then humans (Schurer et al., 2018; Aenishaenslin et al., 2019). Among these, arctic foxes are a reservoir for an arctic variant of the rabies virus, which poses a significant threat as it is mainly transmitted by bites (Aenishaenslin et al., 2014). The cumulative annual incidence of potential human exposure to rabies in Kuujuaq reported between 2008 and 2017 was 3.68/1,000 inhabitants, 92% of which were caused by dog bites. This rate is five to forty times higher than the annual incidence of dog bites reported in the southern regions of Québec in 2016 (0.1 to 0.7/1,000) (Mediouni et al., 2020). Dog attacks can also lead to psychological issues such as anxiety and posttraumatic stress and contribute to social tensions among community members (Dhillon et al., 2019).

Several intertwined factors are deemed to exacerbate dogs-related risks to human health in Nunavik compared to the southern regions of Canada (Aenishaenslin et al., 2019; Daigle et al.,

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2022). Challenges associated with remoteness, limited human, structural and financial resources hinder the provision of veterinary services, including dog vaccination against rabies and antiparasitic treatments. Limited access to sterilization, along with dogs being allowed to roam freely, further complicates the management of canine populations, which is believed to contribute to dog bite rates. Moreover, the lack of adequate veterinary services also has detrimental effects on the health and well-being of dogs themselves, so do social tensions, fear and other negative perceptions toward dogs which may sometimes lead to neglect or mistreatment. Some of these risk factors emerged or developed as a result of significant and sudden changes in the Inuit lifestyle and their relationship with dogs during the 20th century (Lévesque, 2018). Indeed, colonization, settlement, mass culling of dogs in the 1950s–1960s and the adoption of snowmobiles as a means of transportation have led to the decline of traditional practices, including dog sledding (Qikiqtani Inuit Association, 2013). Nonetheless, dogs continue to hold a central role in Nunavik communities.

Since the 1950s, various local, provincial and federal institutions have made efforts to prevent human exposure to rabies through dogs and to better control canine populations. They include local bylaws mandating dog tethering; a provincial program to promote dog vaccination against rabies, by providing vaccine doses and training local lay vaccinators (MAPAQ, 2017); free telemedicine services by the Faculté de médecine vétérinaire (FMV) of the Université de Montréal (<https://chuv.umontreal.ca/vetnunavik/>); temporary neutering and spaying clinics by non-governmental organizations commissioned by some communities – which remain exceptional. However, no substantial a reduction in dog bite rates, potential human exposure to rabies or dog abundance of dogs have been observed, nor has been any improvement in dog welfare (Aenishaenslin et al., 2014; Lévesque, 2018; Mediouni et al., 2020; Daigle et al., 2022; Mediouni et al., 2020). Several obstacles may explain this lack of effectiveness, including difficulties in monitoring dog populations and dog bite incidents, inconsistent allocation of resources, reliance on external organizations and insufficient consideration of Inuit perspectives (Simon et al., 2017). Additionally, current initiatives often overlook the benefits of dogs for human well-being, such as promoting physical activity, providing emotional support and preserving connections with traditional Inuit culture (Lévesque, 2018; Pinello et al., 2022). According to the authors' experience, each of these interventions was implemented independently and no integrated, context-adapted management structure for complex health issues at the human–dog interface exists at the community- or province-level. Furthermore, none of these initiatives has been formally evaluated, including assessing their implementation, which could provide valuable insights into the factors underlying their successes or failures, in relation to their context, and guide potential adjustments (Skivington, 2024).

To address these gaps, in January 2020, a multifaceted pilot project was implemented in the village, with the goal of addressing issues at the interface between humans and dogs. This “*Kuujjuaq Dog Project*” (KDP) consisted of four main components: on-site veterinary services, workshops conducted in schools, educational materials on Facebook and reinforcement of local dog control measures. The logic model of the KDP details its components, inputs, outcomes and expected effects (Appendix 1). Its design, implementation and evaluation were conducted through close collaboration with various local and regional institutions: the NV of Kuujjuaq (municipal council); the Kativik Regional Government (KRG), a non-ethnic public organization created in 1978 pursuant

to the James Bay and Northern Québec Agreement (JBNQA) to deliver public services to Nunavimmiut (inhabitants of Nunavik); the Makivvik Corporation, whose mandates include socio-economic development and preservation of the Inuit language, culture and lands; the Nunavik Research Center (NRC, part of Makivvik Corporation); Kativik Ilisarniliriniq (school board); the Nunavik Regional Board of Health and Social Services (NRBHSS); the Kativik Municipal Housing Bureau (KMHB) and several mushers (i.e., drivers and breeders of dogsledding teams). Its development was based on a community-based multicriteria decision analysis (MCDA) (Aenishaenslin & Ravel, unpublished) and an EcoHealth approach (Charron, 2014). The KDP built on ten years of participatory, multidisciplinary research in Kuujjuaq led by Professor André Ravel as part of the “*Indigenous People, Dogs and Wellness*” (IPDW) project. The four KDP's components were managed separately. In 2018, IPDW researchers and key community actors – mostly volunteers – formed a committee to coordinate the veterinary services. The NV hired its first veterinarian in January 2020. The veterinary services were subsidized thanks to funding from Société du Plan Nord and provided at low rates. In April–May 2021, three IPDW researchers, in collaboration with Kativik Ilisarniliriniq, organized a series of five workshops for 174 students aged 10 to 15 from Jaanimarvik Ilisarniliriniq school. Four workshops, facilitated by the veterinarian and an assistant, focused on dogs' behavior, safe interactions and dog cares. Another was a demonstration of Inuit dog sledding by a musher. Each student also received a copy of the book *Ulaayu learns about rabies* in Inuktitut or English (Whitney, 2018). Between November 2020 and January 2022, a dedicated Facebook page posted eight informative posts on topics such as rabies, dog behavior, core vaccination and deworming. Measures to enhance enforcement of dog bylaws involved mandatory dog registration with tags and increased resources for dog-catching. Under the direction of the Bylaw Enforcement Officer (BLEO), dog catchers are responsible for capturing free-roaming dogs. The dogs are then held in a municipal pound and can be retrieved for a fine. Unclaimed dogs are euthanized after a period ranging from a few days to a few weeks.

The final phase of this project aimed to evaluate the implementation and effects of the KDP. This evaluation was conducted within the broad framework of complex health interventions evaluation (Skivington, 2024) and with a One Health approach, which aims to balance the health of people, animals and ecosystems (OHHLEP, 2022). This paper reports on the implementation analysis, which objectives included assessing the KDP's reach and sociocultural acceptability, and identifying potential barriers and facilitators.

## Methods

The first author (LD) led the data collection, analysis and writing. Three authors are veterinarians and researchers, another is a researcher in social sciences; all four are trained in multidisciplinary approaches and familiar with the context of dogs in Kuujjuaq. They present as non-Indigenous people living in southern Québec. One author presents as a non-Indigenous person living in Kuujjuaq for more than 10 years.

## Theoretical frameworks and study design

This observational study evaluated the KDP's implementation using mixed methods after 2.5 years of operation, in June–July

2022. The multiplicity of its outcomes, the complexity of the underlying causal relationships, the large number of stakeholders and the strong influence of context on its design and implementation make the KDP a complex intervention (Skivington, 2024). Assessing the implementation of such interventions, including contextual factors influencing their reach, facilitating or hindering their delivery, is key to increase their impact and uptake (Skivington, 2024). It also helps understanding how and to which extent an intervention was adapted to fit its context, which can inform its transferability to other settings (Meyers et al., 2012; Skivington, 2024). In addition, it was grounded in key principles of the One Health approach, as defined by the One Health High-Level Expert Panel in 2022 (OHHLEP, 2022). In particular, efforts were deployed to include multiple sectors, traditional forms of knowledge and a diversity of perspectives, especially indigenous ones.

Two conceptual frameworks, Meyers et al. (2012) and Love (2004) informed the implementation indicators detailed in Table 1. Potential factors of exposure to the KDP, implementation facilitators and barriers were also identified through previous research on the specificities of human–dog interactions in the Nunavik settings (Brunet and Lévesque, 2017; Aenishaenslin et al., 2019; Mediouni et al., 2020) and discussion among the IPDW research team. They included sociodemographic factors (gender, age and indigenous status), living with children under 18, participants’ dog breeds (huskies or “southern” breeds) and husbandry (kept inside or outside) and their use of veterinary services outside of the village.

Mixed-methods designs and the integration of key stakeholders have been recommended to evaluate complex interventions, as they help contextualize the results and identify the main facilitators and barriers to its delivery (Skivington, 2024). Similar recommendations have been made for the evaluation of One Health initiatives, with the added need for an intersectoral approach to take account of the different fields involved, in our case human and canine health (Delesalle et al., 2022). Quantitative data were collected through a survey of Kuujjuamiut. Qualitative data were collected through semi-structured individual interviews. Part of these interviews targeted key stakeholders of various sectors and organizations directly involved in the KDP, including education, policy/regulation, veterinary and public health. Quantitative and qualitative data were interpreted together. All participants gave their written consent.

**Data collection**

Appendix 2 details indicators, survey questions/interview themes and corresponding variables. Data were collected by the first author (LD) on-site in June–July 2022.

The survey included 79 questions: Likert-scales, Yes/No and multiple choices. They assessed the veterinary services, school workshops and Facebook posts on three indicators: (1) Relevance, (2) Awareness and exposure and (3) Sociocultural acceptability. For the school workshops, these indicators were evaluated among the students’ parents. A previous unpublished study by Simon et al., focused on the students themselves. Potential factors and sociodemographic data were also included. Recruitment followed a convenience sampling approach with two inclusion criteria: being at least 18 (legal adults) and having lived in Kuujjuaq for at least two years. Solicitation was done through local radio, social media, posters and strategic locations in the village. The survey was administered in English or French, either face-to-face or by phone by the main researcher, or filled out independently by the

**Table 1.** Themes and indicators used for the implementation analysis of the KDP (adapted from [1] Wholey et al., 2004; [2] Meyers et al., 2012)

Themes	Evaluation questions	Indicators
Quality of delivery	Are the clients receiving the outcomes they expected? Is the program producing any unintended positive or negative results? [1] What is the attitude and preparedness of the implementers toward the program implementation? [2] Is the intervention delivered in a manner that is responsive and sensitive to community needs? [2] To which extent does it generalize innovation-specific knowledge to participants’ previous or general knowledge (especially here to indigenous knowledge)? [2]	Perceived effects and effectiveness Relevance Attitude and preparedness of the stakeholders Integration of indigenous knowledge
Participants’ responsiveness	To which degree are the participants engaged in the activities and content of the innovation? [2] To which extent does the innovation hold the interest or attention of participants? [2] Are potential clients rejecting the program or dropping out? Why? [1]	Exposure, awareness, interest Sociocultural acceptability
Differentiation/uniqueness	To which extent the selected innovation differs from other innovations in the organization/community? [2] What are the program’s strengths and weaknesses? [1] What are the areas of requiring improvement? [1]	Perceived strengths and weaknesses Perceived differentiation Possible improvements
Adaptations	To which extent adjustments were made to fit a setting’s needs, resources, preferences, ...? [2] What implementation obstacles are being encountered? [1] Are significant internal or external events affecting the program, its staff, or its clients? [1]	Significant events that could have affected the implementation Obstacles and facilitators

respondent. Respondents received a \$40 gift card to the local store as compensation.

In this study, “key stakeholders” refers to individuals who were/had been actively involved in the implementation, planning or coordination of at least one KDP’s component. They were identified through known partnerships and snowballing, then solicited for an interview via email, phone or in person. Themes centered on their experience and perspectives as KDP’s key stakeholders, as well as adaptations of the intervention (see Appendix 3.1). For the latter, participants completed a timeline of significant events that could have affected the project’s implementation, or the inhabitants’ awareness, perspectives and experiences of the KDP.

For the interviews, other community members were recruited using purposive sampling to ensure representation of diverse

sociodemographic groups and exposure levels to the KDP's components. The same inclusion criteria applied. When appropriate, solicitation occurred at the end of the questionnaire. Otherwise, the same methods as for the survey were used, supplemented by snowballing. All interviewees were compensated with a \$40 gift card to the local store. Recruitment continued until saturation of perspectives. Sociodemographic data was collected when necessary. Themes focused on the participants' experiences and perspectives on the KDP, its strengths and weaknesses (see interview guide in Appendix 3.2).

All interviews were conducted in English or French and audio recorded. Although offered, none of the participants asked for translation to Inuktitut. Interviews lasted 45 to 105 min for key stakeholders, 30 to 60 min for others.

## Data analysis

### Quantitative data (survey)

We conducted a descriptive analysis of each implementation indicator variable. Likert-scales were reduced to three levels (Agree, Neutral, Disagree). An awareness and exposure score  $e_i$  was then calculated for each component: not aware = 0; aware but not exposed = 1; exposed once = 2 (i.e., one post read, veterinary services used once, household children exposed to the workshops); multiple exposure = 3 (not applicable to the school workshops). An overall exposure score  $E$ , ranging from 0 to 8, was obtained by summing the individual scores  $e_i$ . It was categorized into three modalities: "No exposure" ( $E = 0$ ), "Low exposure" ( $1 \leq E \leq 3$ ) and "High exposure" ( $4 \leq E \leq 8$ ). A descriptive analysis was conducted on both individual and global scores.

Analysis was performed using R Statistical Software (v4.3.1; R Core Team, 2023) in RStudio (v2023.06.1+524, RStudio Team, 2022).

### Qualitative data (individual interviews)

The first author (LD) and two firms transcribed the audio recordings. Data were denormalized by assigning an alphanumeric code to each participant. We conducted a computer-assisted thematic analysis with NVivo® software (v2022.7.1.554, QSR International Pty Ltd, 2022). The codebook was developed following both inductive and deductive approaches (Miles et al., 2020), with initial themes drawn from the theoretical frameworks and subcodes created and refined as the analysis progressed. A second researcher (CA) validated the codebook during the initial stages of this process. Interviews of key stakeholders, other community members and timelines were analyzed together.

### Integration of quantitative and qualitative data

A triangulation method guided the integration of the survey and interviews data, in the sense of "a process of studying a problem using different methods to gain a more complete picture" (O'Cathain et al., 2010). After analyzing the data separately, we compared them to identify meta-themes crossing both quantitative and qualitative data. Analysis also followed an iterative approach with quantitative results informing the qualitative analysis, and vice versa.

## Results

### Recruited participants

Descriptive characteristics of all study participants are presented in Table 2. Seventy-four Kuujjuamiut answered the survey. In total,

89 non-stakeholders were solicited for the interviews; 25 participated, among whom 10 also completed the questionnaire. Regarding key stakeholders, 22 were identified, 10 were interviewed, among whom four also completed the questionnaire. We excluded from the analysis two interviewees (out of 25) and eight survey respondents (out of 74) who had lived in Kuujuaq for less than two years or had missing data on this variable.

### Relevance of the KDP

For brevity, results regarding the KDP's relevance are detailed in Table 3 and will only be summarized here. Most of our participants considered dogs to be significant for Inuit culture and the community, while still mentioning associated risks and nuisance, such as bites and rabies (see events in Figure 1). Nuisances were often attributed to "loose" dogs and overabundance, stressing the necessity to better control the population, and confirming the relevance of including better bylaws enforcement in the KDP. Several interviewees emphasized the need to raise awareness of dogs' care and well-being. Some Inuit interviewees explained how mistreating dogs is against their culture and the necessity to integrate Inuit knowledge and perspectives in canine-related interventions. Improving access to veterinary care in the village was a major concern, both to improve dogs' health and to reduce the distress of owners who sometimes have "no choice but to put a dog down because there [was] no services" (K04). Most interviewees (exposed or not) stressed the importance of training the next generation in dog behavior and care in order to bring about change: "It's good for kids to learn early when they're younger, so they'll keep those knowledge as they grow older" (K19). More generally, most survey respondents (see Table 4 and Figure 2) and interviewees felt that the KDP's components met a need and should be continued.

### Participant's exposure and responsiveness to the KDP

Table 5 provides a detailed overview of general exposure. Over half of the respondents had a low score, indicating exposure to only one component or awareness of several but no exposure. All 25 interviewees were aware of at least one component, with 19 being exposed to at least one. No significant differences were found between factors, although the mean score was higher among women, non-Inuit, dog carers and participants who had used external veterinary services before 2020.

Nearly 90% of the survey respondents were at least aware of the veterinary services, with 69% of dog owners having utilized them at least once. The proportion of exposed participants was higher among those who had used external services before 2020 (Table 6). Table 7 details the reasons for consulting veterinary services. Overall, perceptions were positive: "People, no matter what, are really grateful to have a veterinary service" (S05, translated). Furthermore, 75% of the respondents agreed that the services respected the values and beliefs of their community (Table 4 and Figure 2). Some interviewees raised concerns about reaching Inuit people: "If you have a dog and you're qallunaaq [that is non-Inuit], it's pretty automatic to use the vet services, but for people for whom those services are brand new, what's the point? Maybe they don't see it, the value" (K22, non-beneficiary). However, the proportions of Inuit and non-Inuit exposed to the veterinary services were similar (see Table 6). Additionally, key stakeholders made different observations: "[The vet] get calls from everybody, like both southerners and beneficiaries and non-beneficiaries alike is an even mix" (S09).

**Table 2.** Samples structure for the survey and interviews and comparison with 2021 Kuujuaq’s general population

	Kuujuaq’s pop. <sup>1</sup> (N = 2,668)	Survey participants (n = 74)	Interviews participants	
			Non-stakeholders (n = 25)	Key stakeholders (n = 10)
<b>Sex (M/F)</b>	<b>(n = 2,665)</b>	<b>(n = 68)</b>	<b>(n = 25)</b>	<b>(n = 10)</b>
Ratio (M/F)	0.9	0.6	0.6	1
Women	52% (n = 1,375)	62%* (n = 42)	64% (n = 16)	50% (n = 5)
Men	48% (n = 1,290)	38%* (n = 26)	36% (n = 9)	50% (n = 5)
<b>Age group</b>	<b>(n = 1,870)</b>	<b>(n = 72)</b>	<b>(n = 25)</b>	–
18–34 years	39% (n = 735)	32% (n = 23)	28% (n = 7)	–
35–54 years	34% (n = 640)	42% (n = 30)	56% (n = 14)	–
≥55 years	26% (n = 495)	26% (n = 19)	16% (n = 4)	–
<b>Indigenous status<sup>2</sup></b>	<b>(n = 2,665)</b>	<b>(n = 66)</b>	<b>(n = 25)</b>	<b>(n = 10)</b>
JBNQA benef	75% (n = 2,000)	70% (n = 46)	52%* (n = 13)	40%* (n = 4)
Non-beneficiary	24% (n = 635)	30% (n = 20)	48%* (n = 12)	60%* (n = 6)
<b>Years living in Kuujuaq</b>		<b>(n = 68)</b>	<b>(n = 25)</b>	<b>(n = 10)</b>
<2 years <sup>3</sup>	–	3% (n = 2)	8% (n = 2)	0% (n = 0)
2–9 years	–	24% (n = 16)	32% (n = 8)	50% (n = 5)
≥10 years	–	74% (n = 50)	60% (n = 15)	50% (n = 5)
<b>Living with children ≤ 18 years</b>		<b>(n = 74)</b>	<b>(n = 25)</b>	<b>(n = 10)</b>
Yes	–	47% (n = 35)	64% (n = 16)	50% (n = 5)
No	–	53% (n = 39)	36% (n = 9)	50% (n = 5)
<b>Owning/taking care of dog(s)</b>		<b>(n = 74)</b>	<b>(n = 25)</b>	<b>(n = 10)</b>
Yes, one	–	38% (n = 28)	76% (n = 19)	60% (n = 6)
Yes, more than one	–	26% (n = 19)		
No	–	36% (n = 27)	24% (n = 6)	40% (n = 4)
<b>Dogs’ breed</b>		<b>(n = 39)</b>	<b>(n = 18)</b>	<b>(n = 5)</b>
Sledding dogs	–	13% (n = 5/39)	11% (n = 2)	20% (n = 1)
Huskies	–	51% (n = 20/39)	39% (n = 7)	80% (n = 4)
Other breeds <sup>5</sup>	–	28% (n = 11/39)	22% (n = 4)	0% (n = 0)
Both type of breeds	–	8% (n = 3/39)	28% (n = 5)	0% (n = 0)
<b>Dogs’ husbandry</b>		<b>(n = 44)</b>	–	–
Mostly inside	–	30% (n = 13/44)	–	–
Mostly outside	–	59% (n = 26/44)	–	–
On a leash	–	52% (n = 23/44)	–	–
Free roaming	–	5% (n = 2/44)	–	–
Both	–	2% (n = 1/44)	–	–
Inside and outside	–	11% (n = 5/44)	–	–

Note: \*Statistical difference with general population (z-test,  $p < 0.5$ ).

<sup>1</sup>Source: Census of Population.

<sup>2</sup>Statistics Canada 2021 census also reports 10 persons identifying from First Nations, 10 from Métis and 10 from multiple Indigenous groups.

<sup>3</sup>Excluded from the analysis.

Twenty-seven percent (27%) of the survey respondents and 39% of those living with children were at least aware of the school workshops (see Table 6). Two interviewees shared their children’s positive experience and notions they learned: “They love animals, so they were very interested in how they get rabies and how to prevent, how to identify if they got sick from the rabies” (K11).

Exposed survey participants also reported their children being happy or very happy with the activities (86% [49–87],  $n = 6/7$ ). Stakeholders involved with the workshops confirmed the students’ interest: “engaging with the kids is 100% good. They need it, they want it” (S10). Quantitative results also supported a good sociocultural acceptability (see Table 4 and Figure 2).

**Table 3.** Perceptions of dogs

	Proportion of survey respondents that agree	Related quotes from the interview
<b>Dogs are part of my community.</b>		
Total (n = 65)	85% [77–92]	<i>“At the end, I think that animals are the best in terms of how they create healing. And dogs especially are very empathetic to humans. They tend to be very supportive in that sense” (S10)</i>
By indigenous status		
Inuit (n = 42)	81% [71–89]	
Non-Inuit (n = 17)	94% [88–100]	
By dog owning		
Dog owners (n = 39)	92% [87–100]	
Non dog owners (n = 26)	73% [62–92]	
By living with children ≤ 18 years old		
Yes (n = 33)	82% [73–96]	
No (n = 32)	88% [81–100]	
<b>Dogs can keep my house safe.</b>		
Total (n = 61)	84% [77–93]	<i>“The reason why I got a dog is it’s like an alarm system. Especially when I’m camping. [...] You’ll notice if there’s maybe somebody that’s not usually come around our place, he’ll sense. And if the person is aggressive or menacing-looking, then he will sound the alarm” (K15)</i>
By indigenous status		
Inuit (n = 39)	90% [82–98]	
Non-Inuit (n = 17)	65% [47–89]	
By dog owning		
Dog owners (n = 38)	79% [68–92]	
Non dog owners (n = 23)	91% [87–100]	
By living with children ≤ 18 years old		
Yes (n = 31)	84% [74–96]	
No (n = 30)	83% [73–96]	
<b>Dogs are important to the Inuit culture.</b>		
Total (n = 62)	95% [92–100]	<i>“Dogs have played a huge role in our history. They were a source of transportation to hunt for food. [...] They still play a huge role in our lives, like they are... They are not just pets, they’re like... They’re like part of family” (K04, Inuit)</i> <i>“They’re our best friend, dogs. Without dogs, Inuit wouldn’t have survived” (S04, Inuit musher)</i>
By indigenous status		
Inuit (n = 40)	95% [90–100]	
Non-Inuit (n = 17)	94% [88–100]	
By dog owning		
Dog owners (n = 38)	92% [87–100]	
Non dog owners (n = 24)	100% [100–100]	
By living with children ≤ 18 years old		
Yes (n = 33)	94% [88–100]	
No (n = 29)	97% [93–100]	
<b>Sled dogs are part of the Inuit culture.</b>		
Total (n = 65)	100% [100–100]	<i>“In our culture, dog teams have always been part of the family. If you look at the old photos starting from the first photographs of explorers coming to the Arctic, what do you see? People with their dogs.[...] So a few mushers, we are trying to keep a small part of our culture [...]. It’s just a tiny part that I find very, very unique that we’re trying to keep alive.” (S08, Inuit musher)</i>
By indigenous status		
Inuit (n = 42)	100% [100–100]	
Non-Inuit (n = 17)	100% [100–100]	
By dog owning		
Dog owners (n = 39)	100% [100–100]	
Non dog owners (n = 26)	100% [100–100]	
By living with children ≤ 18 years old		
Yes (n = 33)	100% [100–100]	
No (n = 32)	100% [100–100]	

(Continued)

**Table 3.** (Continued)

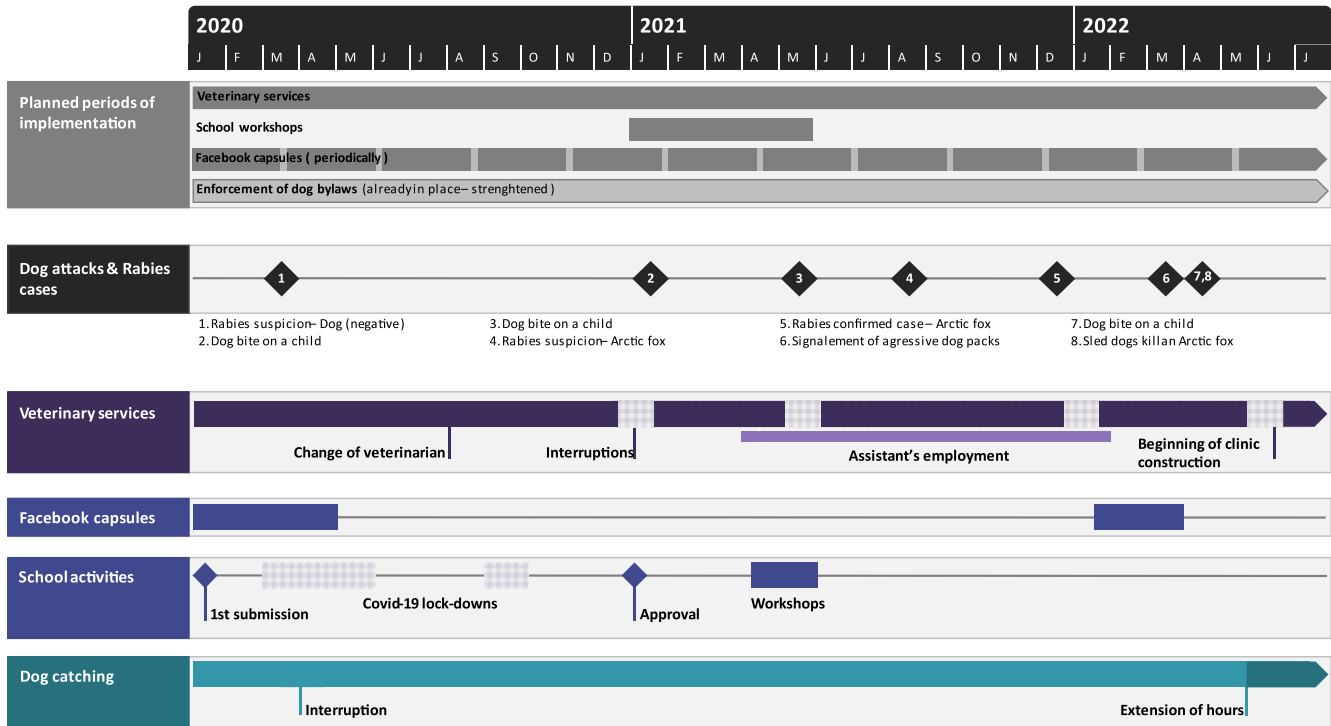
Proportion of survey respondents that agree		Related quotes from the interview
<b>I like watching sledding or hearing that there is sledding around the village.</b>		
Total (n = 63)	89% [83–96]	
By indigenous status		
Inuit (n = 40)	90% [82–98]	
Non-Inuit (n = 17)	94% [88–100]	
By dog owning		
Dog owners (n = 38)	89% [82–97]	
Non dog owners (n = 25)	88% [80–100]	
By living with children ≤ 18 years old		
Yes (n = 31)	90% [84–100]	
No (n = 32)	88% [81–100]	
<b>Children tend to put themselves at risk of being bitten by a dog</b>		
Total (n = 64)	80% [72–90]	<i>“Kids love dogs. And some might be sick with rabies and everything like that. So, I think it’s good that they’re informed about these risks” (K03)</i>
By indigenous status		
Inuit (n = 41)	80% [71–93]	
Non-Inuit (n = 17)	82% [71–100]	
By dog owning		
Dog owners (n = 39)	79% [69–92]	
Non dog owners (n = 25)	80% [68–95]	
By living with children ≤ 18 years old		
Yes (n = 32)	75% [62–90]	
No (n = 32)	84% [75–97]	
<b>Globally, there are too many free-roaming dogs in my community</b>		
Total (n = 65)	88% [82–96]	<i>“What concerns me, when you see packs of dogs, sometimes there’s five, six, seven, or even larger, I just fear for the safety of, mostly, children, but it’s not only children, that something bad can happen” (S08)</i> <i>“It’s a source of irritation for many people, and a source of worry for children. And it’s one of the things that feeds the mistrust between child, dog, parent, you know, being on the defensive all the time” (K17, translated)</i>
By indigenous status		
Inuit (n = 42)	88% [81–98]	
Non-Inuit (n = 17)	94% [88–100]	
By dog owning		
Dog owners (n = 39)	90% [82–98]	
Non dog owners (n = 26)	85% [77–100]	
By living with children ≤ 18 years old		
Yes (n = 33)	88% [82–100]	
No (n = 32)	88% [78–97]	

Note: Proportion (with [95% confidence interval]) of the survey participants agreeing with each statement, and related quotes from the individual interviews.

Just over half of the survey participants were aware or exposed to the Facebook posts, with a lower proportion among Inuit, males, respondents aged 55 or over, and those living with children (see Table 6). This social media was confirmed as “a good way to get the word out,” given that “a lot more people are on social media these days” (K03), although the dedicated page was unknown to some study participants (see Table 4 and Figure 2). A few non-Inuit community members expressed concerns that posting about bites and rabies could negatively affect the perception of dogs.

According to some, conflicts often emerge in the comments of dog-related posts; such an event occurred for one of the posts. Nevertheless, all exposed interviewees gave positive feedback: “They were useful in the fact that they give you tips” (K01).

Perceptions of enforcement of the dogs’ bylaws were mixed. Indeed, numerous interviewees, mainly Inuit, perceived tethering northern dogs as contrary to their natural behavior: “When they’re puppies, growing up, when you have it tied up, it’s heartbreaking. Because these dogs were made to run around, not tied up in a limited



**Figure 1.** Timeline of the Kuujuaq Dog Program and significant dogs-related events. Synthesis of the timelines completed by the stakeholders and of the interviews with stakeholders and other community members.

space” (K13, Inuit). Catching free-roaming dogs, impounding them and euthanizing them when unclaimed were also sensitive issues. But at the same time, all acknowledged that these measures were “necessary, because we get too overpopulated by dogs, loose dogs that have no owners” (K13).

### Differentiation, strengths and weaknesses of the KDP

The proximity and continuity of veterinary services were major improvements compared to previous interventions: “I think one-time services, you know, it’s a plaster, but now, by having a constant presence, that’s where a change can be made” (S07, translated). Nonetheless, some interviewees reported delays and interruptions during the veterinarian’s leave of absence. Moreover, several services were unavailable at the time of the study due to a lack of equipment. This included sterilization, accessible only for males: “It would certainly be great to be able to operate on both males and females. I really think it could make a difference. It hasn’t been very accessible yet though” (K17, translated). Since autumn 2022, the construction of a clinic has remedied some of these gaps. Finally, the services’ affordability was a major asset: “Before, I used to say that we were about 1/6 of the prices in the South, but now I think we’re 1/8. 1/10 sometimes” (S05, translated). Indeed, prior to the KDP, the only way to access complete veterinary care was to send the animal to a Montréal clinic, which was an expensive option that many Kuujuaumiut could not afford.

The school workshops were also perceived as a novelty. Exposed participants and involved key stakeholders particularly emphasized the added value of integrating Inuit cultural elements: “When they did it with the dog team, that was nice. It made me feel proud that, hey, they do care about our mushers. [...] And [my girls] feel proud that somebody wants to help and keep the tradition

alive” (K11, Inuit). Another strength laid in them being run by a veterinarian, which according to parents “gives kids an opportunity to dream a little bit” (K02). Meanwhile, some called for more contextualization within the school curriculum and a repetition of the workshops, so that “the discourse is sustainable in the long term. Because otherwise, it’s an activity, but after that, what’s the basis for it in the community?” (S03, translated).

Regarding the Facebook posts, the interviewees confirmed the media’s practicality for disseminating information within the community: “You don’t have to look everywhere for answers. [...] You can go to one place and you can ask questions at one place” (K11). Furthermore, the posts helped spread the word about the veterinary services: 46% ([36–62], n = 27/55) of the respondents aware of the services learned about them through social media.

### Adaptation, barriers and facilitators

Interviews and timelines revealed deviations from the KDP’s initial plan, as synthesized in Figure 1, including direct and indirect impacts of Covid-19. Participants identified several factors affecting the project’s implementation and underlined their interrelations. In addition to remoteness and lack of material, financial and structural resources, two other levers were highlighted.

First, the challenges of multiple engagement, unclear roles and mandates, high turnover and extended leaves of absence of outside workers hindered the delivery of the KDP’s components: “Here it’s difficult because people go on vacation every two months, and sometimes two people go on vacation for two months at a time, so it’s always a big challenge to keep projects going” (S07, translated). More generally, the lack of human resources was a significant impediment, especially for veterinary services and dog control.



**Table 4.** Perceived relevance and sociocultural acceptability of the Kuujuaq Dog Project's components

	% of aware survey participants that agreed that the intervention . . .		
	Met a need	Should be carried out	Respected the values and beliefs of the community
<b>Facebook capsules (n = 36)</b>	<b>83% [75–96]</b>	<b>81% [72–94]</b>	<b>67% [53–81]</b>
Indigenous status			
Inuit (n = 21)	86% [76–100]	81% [71–100]	81% [71–100]
Non-Inuit (n = 12)	92% [83–100]	92% [83–100]	58% [42–91]
Own dogs			
Yes (n = 23)	83% [74–100]	87% [78–100]	65% [52–87]
No (n = 13)	85% [77–100]	69% [54–98]	69% [54–98]
Children in the household			
Yes (n = 16)	69% [50–89]	75% [62–98]	69% [50–89]
No (n = 20)	95% [90–100]	85% [75–100]	65% [50–88]
<b>School workshops (n = 18)</b>	<b>78% [67–99]</b>	<b>89% [83–100]</b>	<b>78% [67–99]</b>
Indigenous status			
Inuit (n = 12)	83% [75–100]	92% [83–100]	75% [58–100]
Non-Inuit (n = 4)	75% [50–100]	100% [100–100]	75% [50–100]
Own dogs			
Yes (n = 13)	77% [62–100]	92% [85–100]	77% [62–100]
No (n = 5)	80% [60–100]	80% [60–100]	80% [60–100]
Children in the household			
Yes (n = 13)	69% [54–97]	85% [77–100]	69% [54–98]
No (n = 5)	100% [100–100]	100% [100–100]	100% [100–100]
<b>Veterinary services (n = 59)</b>	<b>90% [85–98]</b>	<b>90% [85–98]</b>	<b>79% [71–89]</b>
Indigenous status			
Inuit (n = 39)	86% [78–97]	86% [78–97]	81% [73–95]
Non-Inuit (n = 17)	100% [100–100]	100% [100–100]	79% [68–99]
Own dogs			
Yes (n = 35)	91% [86–100]	91% [86–100]	74% [62–88]
No (n = 24)	88% [79–100]	86% [79–100]	88% [79–100]
Children in the household			
Yes (n = 31)	81% [71–85]	84% [74–97]	74% [61–88]
No (n = 31)	100% [100–100]	96% [93–100]	85% [78–100]

Note: Percentage of participant agreeing with each statement by intervention, and related quotes from the individual interviews.

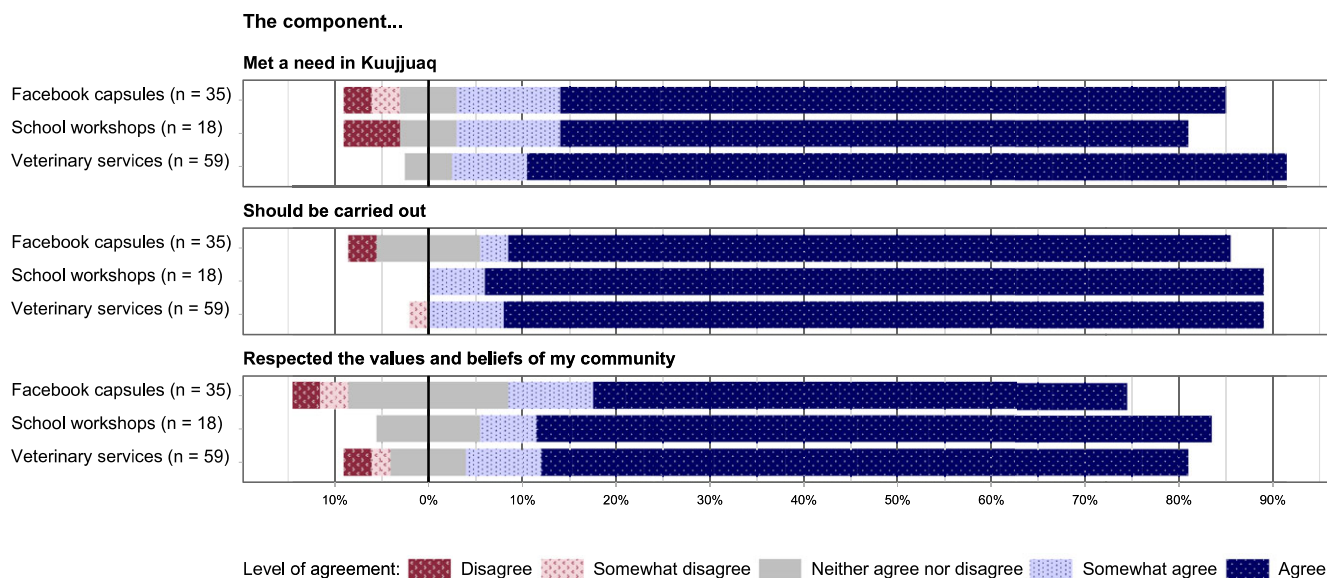
Nevertheless, a few also identified cooperation and teamwork as facilitators: “It’s been a long arduous trip with a lot of people putting out at some time, a lot of people helping out at other times” (S09).

Second, resistance was sometimes encountered from community members or other stakeholders. This was the case for the enforcement of dog bylaws: “People don’t respect that they have to leash their dogs. Not 100% yet anyways. I would say 50% of the population do respect that” (K09). Interviewees recounted people – including children – untying dogs, freeing them from the pound or from dog catchers’ traps. Wariness and social tensions around dog-related topics also hindered the engagement of some of the stakeholders. Meanwhile, trust between external academics and the community members benefitted from the long-term commitment of the researchers: “That’s the great thing about your

program, it’s that you’re there every year. [. . .] And also that you come to the North, there’s a lot of research that’s done from the south, and they don’t understand the reality, but being on site, you see that reality” (K24, translated). Presenting as a veterinarian also facilitated acceptance by the population and local partners. Finally, to “encourage discussions with groups of stakeholders who are involved locally” (S03, translated), especially mushers, was a major facilitator.

## Discussion

This study used mixed methods to evaluate the implementation of the first integrated intervention addressing issues at the human–dog interface in northern Québec with an EcoHealth approach.



**Figure 2.** Relevance and acceptability of the Kuujjuaq's Dog Program. Percentage of participants by degree of agreement to each affirmations. Legend (from left to right): chevron on dark background: disagree; chevron on light background: somewhat disagree; solid gray: neither agree nor disagree; dots on lights background: somewhat agree; dots on dark background: agree.

Results indicate a varying reach depending on the component and sociodemographic factors, such as gender or JBNQA status. Barriers to implementation included limited human and structural resources, stakeholder engagement and individual resistance. Few similar interventions have been documented in remote indigenous communities of the Canadian (sub)arctic (Lidstone-Jones and Gagnon, 2016; Boissonneault and Epp, 2018; Baker et al., 2021; Schurer, McKenzie, et al., 2015). Evaluations of these interventions often focus on their impacts, with little information on how the context could have impacted the production of these effects. However, it is crucial to comprehend these processes to evaluate the quality and applicability of the evidence “in real-world settings,” and to assess their transferability to other contexts (Skivington, 2024).

### Reach and acceptability of the KDP

The sociocultural acceptability of the KDP was generally positive, except for the regulation of free-roaming dogs, perceived as a “necessary evil.” Mixed perceptions about dog regulations are consistent with previous studies in Kuujjuaq or other Nunavik communities (Aenishaenslin et al., 2019; Daigle et al., 2023). The predominance of positive outlooks on the project, as well as the evidence of its relevance to the community settings and concerns, may be attributed to its participatory design, which allowed prioritizing the community's needs, and to the strong demand from Kuujjuamiut for this type of intervention (as shown in Table 4).

The project reached almost all study participants, with only four individuals reporting no awareness of any of its components. The high uptake of the veterinary services was expected and is consistent with other veterinary programs in remote Canadian communities, although differences in objectives and measurement indicators make comparisons difficult (Lidstone-Jones and Gagnon, 2016; Baker et al., 2021; Schurer, Phipps, et al., 2015). Although some studies have reported Indigenous people's mistrust

of veterinary services, exposure to and acceptability of services were similar between Inuit and non-Inuit participants (LaVallee et al., 2017; Baker et al., 2018; Schurer, McKenzie, et al., 2015). However, reasons for visits differed, with fewer sterilizations among non-Inuit participants and less illness/injury visits among Inuit participants. Several factors may explain these variations, such as differences in perspectives on dogs, access to southern clinics for sterilization, or profiles of participants' dogs owned (e.g., breed and husbandry, see Appendix 4) (Brook et al., 2010; Lidstone-Jones and Gagnon, 2016; Baker et al., 2021).

A quarter of the survey respondents reported indirect exposure to school workshops. Although parents' exposure to and perception of the workshops does not represent that of their children, both provided valuable information on the implementation of the KDP. First, as participation to the workshops required parental consent, the sociocultural acceptability of said workshops by parents could have affected their reach among students. Second, exposed interviewees recalled concepts learned by the children, suggesting while targeting children, these educational activities may have had a positive impact on their relatives (Table 6). The participation of the veterinarian was welcomed as a way of inspiring students to pursue a career in veterinary medicine and possibly return to their village as veterinarians themselves. Brook et al. (2010) reported similar findings after conducting an intervention in communities in the Sahtu settlement area (Northwest Territories, Canada), during which young students were invited to participate in temporary veterinary clinics. Working with mushers increased interest in and acceptance of the workshops. In addition to transmitting traditional knowledge, it promoted a positive image of dogs.

The Facebook posts reached just over half of survey respondents. According to our local partners and to the interviewees, the platform is widely used by Kuujjuamiut. Nevertheless, it excludes some residents, particularly older ones (Table 6). Furthermore, the posts were not translated into Inuktitut and their mostly-text format was sometimes considered

**Table 5.** Global exposure to the Kuujuaq Dog Program

	Exposure score		Exposure level		
	Mean	Mode(s)	Nul	Low	High
Total (n = 66)	3.2 [2.6–3.7]	1	6% [0–19]	59% [44–68]	39% [29–53]
By sex					
Females (n = 39)	3.5 [2.7–4.2]	1	3% [0–20]	49% [36–67]	49% [36–67]
Males (n = 25)	2.2 [1.4–3.1]	1	12% [0–33]	60% [44–81]	28% [12–49]
By age					
18–34 years (n = 24)	3.5 [2.5–4.4]	1 and 5	4% [0–26]	46% [29–68]	50% [33–72]
35–54 years (n = 28)	3.0 [2.0–4.0]	1	11% [0–29]	46% [29–65]	43% [25–61]
≥55 years (n = 13)	2.4 [1.7–3.2]	1 and 2	0% [0–22]	85% [77–100]	15% [8–38]
By JBNQA status					
Beneficiaries (n = 42)	2.9 [2.2–3.5]	1	5% [0–19]	60% [45–74]	36% [21–50]
Non benef. (n = 18)	3.7 [2.5–4.9]	1 and 4	6% [0–32]	39% [22–65]	56% [39–82]
By dog owning					
Dog owners (n = 39)	3.6 [2.8–4.4]	2, 3 and 5	8% [0–23]	41% [26–56]	51% [36–67]
Non dog owners (n = 27)	2.1 [1.5–2.8]	1	4% [0–22]	74% [63–92]	22% [11–41]
By living with children ≤ 18					
Yes (n = 33)	3.4 [2.6–4.2]	3	6% [0–24]	55% [39–73]	39% [24–58]
No (n = 33)	2.6 [1.8–3.3]	1	6% [0–24]	55% [39–73]	39% [24–58]
By usage of external vet services before 2020*					
Used (n = 27)	4.0 [3.1–4.9]	5	0% [0–20]	37% [22–57]	63% [48–83]
Did not use (n = 39)	2.4 [1.8–3.0]	1	10% [0–25]	67% [54–82]	23% [10–38]

Note: Exposure score mean and mode, and percentage of survey respondents, with [95% confidence interval]. \*Significant relationship (exact Fisher test,  $p < 0.05$ ).

**Table 6.** Awareness of, and exposure to each component of the kuujuaq dog program

	Not aware	Aware - not exposed	Exposed
<b>Facebook capsules</b>			
Total (n = 66)	45% [33–58] (n = 30)	12% [0–56] (n = 8)	42% [30–56] (n = 28)
By sex			
Females (n = 39)	31% [18–48] (n = 12)	13% [0–30] (n = 5)	56% [44–74] (n = 22)
Males (n = 25)	68% [52–86] (n = 17)	8% [0–26] (n = 2)	24% [8–42] (n = 6)
By age			
18–34 years (n = 24)	33% [17–55] (n = 8)	12% [0–35] (n = 3)	54% [38–76] (n = 13)
35–54 years (n = 28)	46% [29–65] (n = 13)	11% [0–29] (n = 3)	43% [25–61] (n = 12)
≥55 years (n = 13)	62% [38–85] (n = 8)	15% [0–39] (n = 2)	23% [0–46] (n = 3)
By indigenous status (JBNQA)			
Non-Inuit (n = 18)	33% [17–61] (n = 6)	17% [0–44] (n = 3)	50% [33–77] (n = 9)
Inuit (beneficiaries) (n = 42)	50% [36–66] (n = 21)	7% [0–23] (n = 3)	43% [29–59] (n = 18)
By dog owning			
Non dog owners (n = 27)	52% [37–74] (n = 14)	15% [0–37] (n = 4)	33% [19–55] (n = 9)
Dog owners (n = 39)	41% [26–57] (n = 16)	10% [0–26] (n = 4)	49% [33–65] (n = 19)
By living with children ≤ 18 years			
No (n = 33)	39% [24–58] (n = 17)	12% [0–31] (n = 4)	48% [33–67] (n = 16)
Yes (n = 33)	52% [36–70] (n = 13)	12% [0–31] (n = 4)	36% [21–55] (n = 12)

(Continued)

Table 6. (Continued)

	Not aware	Aware – not exposed	Exposed
<b>School activities</b>			
Total (n = 66)	73% [64–84] (n = 48)	15% [6–26] (n = 10)	12% [3–23] (n = 8)
By sex			
Females (n = 39)	77% [67–91] (n = 30)	10% [0–24] (n = 4)	13% [3–26] (n = 5)
Males (n = 25)	68% [52–85] (n = 17)	20% [4–37] (n = 5)	12% [0–29] (n = 3)
By age			
18–34 years (n = 24)	79% [67–95] (n = 19)	12% [0–28] (n = 3)	8% [0–24] (n = 2)
35–54 years (n = 28)	71% [57–88] (n = 20)	11% [0–27] (n = 3)	18% [4–34] (n = 5)
≥55 years (n = 13)	62% [38–85] (n = 8)	31% [0–54] (n = 4)	8% [0–31] (n = 1)
By indigenous status (JBNQA)			
Non-Inuit (n = 18)	78% [67–99] (n = 14)	11% [0–32] (n = 2)	11% [0–32] (n = 2)
Inuit (beneficiaries) (n = 42)	71% [60–85] (n = 30)	17% [5–30] (n = 7)	12% [0–25] (n = 5)
By dog owning			
Non dog owners (n = 27)	81% [70–96] (n = 22)	11% [0–25] (n = 3)	7% [0–22] (n = 2)
Dog owners (n = 39)	67% [54–82] (n = 26)	18% [5–33] (n = 7)	15% [3–30] (n = 6)
By living with children ≤18 years			
No (n = 33)	85% [76–97] (n = 28)	15% [6–28] (n = 5)	0% [0–12] (n = 0)
Yes (n = 33)	61% [45–77] (n = 20)	15% [0–32] (n = 5)	24% [9–41] (n = 8)
<b>Veterinary services</b>			
Total (n = 66)	11% [0–23] (n = 7)	47% [35–59] (n = 31)	42% [30–55] (n = 28)
By sex			
Females (n = 39)	10% [0–26] (n = 4)	44% [28–60] (n = 17)	46% [31–62] (n = 18)
Males (n = 25)	12% [0–34] (n = 3)	52% [36–74] (n = 13)	36% [20–58] (n = 9)
By age			
18–34 years (n = 24)	12% [0–35] (n = 3)	38% [21–60] (n = 9)	50% [33–73] (n = 12)
35–54 years (n = 28)	11% [0–29] (n = 3)	50% [32–68] (n = 14)	39% [21–58] (n = 11)
≥55 years (n = 13)	8% [0–35] (n = 1)	54% [31–81] (n = 7)	38% [15–66] (n = 5)
By indigenous status (JBNQA)			
Non-Inuit (n = 18)	6% [0–32] (n = 1)	39% [22–65] (n = 7)	56% [39–82] (n = 10)
Inuit (beneficiaries) (n = 42)	12% [0–28] (n = 5)	45% [31–62] (n = 19)	43% [29–59] (n = 18)
By dog owning			
Non dog owners (n = 27)	11% [4–26] (n = 3)	85% [78–100] (n = 23)	4% [0–18] (n = 1)
Dog owners (n = 39)	10% [0–25] (n = 4)	21% [8–35] (n = 8)	69% [56–83] (n = 27)
By living with children ≤18 years			
No (n = 33)	15% [0–34] (n = 5)	52% [36–70] (n = 17)	33% [18–52] (n = 11)
Yes (n = 33)	6% [0–25] (n = 2)	42% [27–61] (n = 14)	52% [36–70] (n = 17)
By previous use of external veterinary services (before 2020)			
No (n = 39)	18% [5–34] (n = 7)	64% [51–80] (n = 25)	18% [5–34] (n = 7)
Yes (n = 27)	0% [0–17] (n = 0)	22% [11–39] (n = 6)	78% [67–95] (n = 21)
By exposure to the Facebook capsules			
Did not read any (n = 38)	13% [0–31] (n = 5)	58% [45–75] (n = 22)	29% [16–46] (n = 11)
Read at least one (n = 28)	7% [0–27] (n = 5)	32% [18–52] (n = 9)	61% [46–81] (n = 17)

Note: Proportion of participants with [95% confidence interval].

**Table 7.** Reasons for consulting the veterinary services

	Vaccines	Spaying/Neutering	Sickness/Injury
<b>Total (n = 28)</b>	96% [82–99]	25% [13–43]	46% [30–64]
<b>By owner's indigenous status</b>			
Inuit (n = 18)	94% [74–99]	33% [16–56]	39% [20–61]
Non-Inuit (n = 10)	100% [100–100]	10% [2–40]	60% [31–83]
<b>By dogs' breeds</b>			
Sledding dogs (n = 5)	40% [12–77]	20% [4–62]	25% [11–47]
Huskies (n = 20)	55% [34–74]	15% [5–36]	25%* [11–47]
Other breeds (n = 11)	73% [43–90]	9% [2–38]	45% [21–72]
Huskies and other breeds (n = 3)	100% [100–100]	67% [21–94]	67% [21–94]
<b>By dogs' husbandry</b>			
Mostly inside (n = 13)	85% [58–96]	15% [4–42]	69% [42–87]
Mostly outside (n = 26)	54% [35–71]	15% [6–34]	23% [11–42]
Both (n = 5)	80% [38–96]	40% [12–77]	40% [12–77]

Note: Percentages of the survey respondents who used the KDP's veterinary services with [95% confidence interval]. As respondents could give several answers for breed and husbandry, these variables categories are not exclusive.

inappropriate. To increase the reach of such educational efforts, distribution channels should be diversified. Radio, in particular, is the primary local and regional medium and can reach other communities. Relying on key events, such as the Ivakkak Dog Sled Race, could contribute to a positive perception of dogs and the KDP.

### An innovation in northern Québec and Canada

The KDP represents a significant shift from previous dog-related interventions in Kuujuaq, northern Québec and more broadly, northern Canada. First, participants identified on-site, quasi-permanent and low-cost veterinary services as the major innovation, stating that “*there was nothing before*” (K02). Subsidized veterinary services in northern Canadian communities typically consists of temporary clinics providing a limited range of services (spay/neuter, vaccination) and, with one exception, are short-term interventions (Baker et al., 2018, 2021; Boissonneault and Epp, 2018; Lidstone-Jones and Gagnon, 2016; Schurer, McKenzie, et al., 2015; Schurer, Phipps, et al., 2015). Second, to our knowledge, only two other dog-related interventions in northern Canada have included an educational component (Brook et al., 2010; Lidstone-Jones and Gagnon, 2016), despite the documented need (Beaver et al., 2001; Boissonneault and Epp, 2018; Daigle et al., 2023). Finally, only one of these interventions explicitly claimed a One Health approach and considered the “*spiritual and cultural needs of the communities*” (Schurer, McKenzie, et al., 2015; Schurer, Phipps, et al., 2015).

### Challenges to overcome for a sustainable intervention

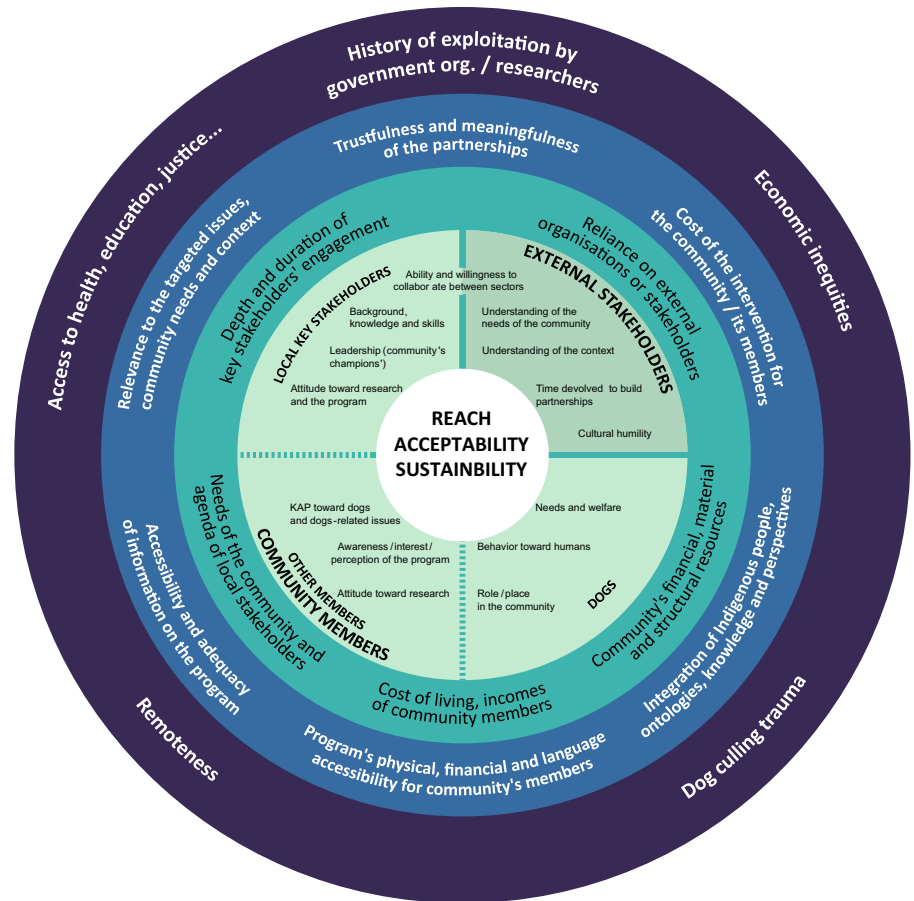
Our study highlighted an array of interrelated barriers and facilitators that may influence outreach, acceptability and long-term sustainability of the KDP, which are illustrated in Figure 3. Most had already been identified as factors affecting northern communities' dog-related issues (Aenishaenslin et al., 2014; Mediouni et al., 2020; Daigle et al., 2022; Mediouni et al., 2020), implementation of interventions addressing these issues (Baker

et al., 2018; Beaver et al., 2001, p. 20; LaVallee et al., 2017; Daigle et al., 2023), or One Health and community-based interventions (McCloskey et al., 2011; Delesalle et al., 2022; Potes et al., 2023). Since dogs are “*nobody's mandate*” (S06), stakeholder engagement seemed difficult to sustain and intersectoral cooperation was essential. This collaboration, however, was only partial, as the KDP's components were managed independently. Since the study, the veterinary services and population control measures, both managed by local stakeholders, are still in progress. Veterinary services are now delivered through regular visits of intern students of the FMV to Kuujuaq's clinic.

Systemic inequities and historical determinants (colonial past, Inuit dogs slaughter) underlie many of these barriers and facilitators. Access to education is one of them, with no animal health training available in Nunavik to date and, more generally, limited access to post-secondary education for Inuit living in Inuit Nunangat (i.e., Inuit lands of the Canadian Arctic). Indeed, in 2021, less than 24% of them had completed post-secondary education, a proportion three times lower than that of the general population in Québec (74%) and Canada (72%) (percentage of 25–64 age group, Statistics Canada, 2023, 2024). These barriers could be overcome by developing local training of community-based animal health workers, capable of providing basic veterinary care, in addition to vaccination. Paraprofessionals are a proven asset to equitable access to veterinary services and public health in remote communities (Catley et al., 2004). They would also improve language accessibility, valorization of local knowledge and community engagement.

### Limits

The study has several limitations. Convenience sampling was recommended by local partners but makes it difficult to extrapolate findings to the general Kuujuaq population. Selection bias in favor of Kuujuaqmiut most interested in dog-related topics is likely and may have resulted in overestimating the project's reach and social acceptability. The sex ratio is skewed



**Figure 3.** Factors affecting the implementation of the Kuujuaq's Dog Program. As identified through the interviews, survey and/or literature. Legend: from inner to outer circle: factors at the individual level; factors at the community level; factors related to the program's design; systemic / environmental factors.

toward women (Table 2). As gender may affect the risk of dog bites (Daigle et al., 2022), it may indirectly influence response to the KDP. The proportion of dog owners in our sample is consistent with estimates from local stakeholders, although comprehensive data on the dog population in Kuujuaq are not currently available. The proportion of Inuit participating in the survey is not significantly different from that of the general population, which has been considered difficult to reach (Aenishaenslin et al., 2019). On the other hand, they were underrepresented among the key stakeholders and other community members interviewed. Nevertheless, five mushers – more than half of those from Kuujuaq – participated in the study, which contributed to the inclusion of Inuit perspectives. Finally, recall bias may have affected the assessment of the project's reach, especially for school activities. In addition, the low power of the study, due to small sample size, prevented the identification of statistically significant associations between exposure to the components and potential factors. However, the use of mixed methods partially mitigates the limitations of the study (Creswell and Plano Clark, 2018). Triangulating qualitative and quantitative data helped to contextualize the findings, increasing their depth and validity. Document analysis (e.g., veterinary and dog registration records, Facebook comments . . .) would have further strengthened this triangulation, but such data were difficult to access at the time of the study.

## Conclusions

This paper presents results from the implementation analysis of a pilot project aimed at addressing issues at the human–dog interface in an Inuit community of northern Québec, Canada. The KDP's multisectoral, participatory approach, combining veterinary services and population management with education, is innovative in the Canadian (sub)Arctic. The evaluation of its implementation emphasizes the critical role of local stakeholder engagement and intersectoral collaboration in the sustainability of such community-based interventions. Our study will not only guide future evolution of the KDP but also inform its transferability to other villages in northern Québec and Canada. Additionally, it fills knowledge gaps about the facilitators and barriers to implementing complex dog-related interventions in northern indigenous communities.

**Supplementary material.** The supplementary material for this article can be found at <https://doi.org/10.1017/one.2024.10>.

**Data availability statement.** In accordance with the recommendations of the Ikaarvik Youth SciQ summit (2018) and the Assembly of First Nations Québec-Labrador (AFNQL, 2014), the data supporting the results of this study are considered to be the property of the community of Kuujuaq. Consequently, they will be shared upon request to the corresponding author, LD, and with the agreement of village representatives.

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**Author contribution.** The authors confirm contribution to the paper as follows: conceptualization: LD, CA, AR. Investigation: LD. Data curation: LD. Data analysis: LD, CA. Visualization: LD. Funding acquisition: AR, CA. Project administration: AR, CA. Supervision: CA, AR. Writing – original draft: LD. Writing – review and editing: LD, CA, JSC, LC, AR.

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**Competing interests.** None.

**Ethics statement.** The protocol of this study was approved by the ethical committee of the Université de Montréal (Comité d'éthique de la recherche en santé, CERSES-21-062-D).

## Connections references

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