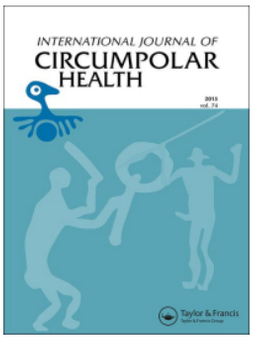

International Journal of Circumpolar Health

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/zich20

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To cite this article: Laura Eichelberger, Amanda Hansen, Patricia Cochran, Micah Hahn & Ruby Fried (2023) COVID-19 vaccine decision-making in remote Alaska between November 2020 and November 2021, International Journal of Circumpolar Health, 82:1, 2242582, DOI: 10.1080/22423982.2023.2242582

To link to this article: https://doi.org/10.1080/22423982.2023.2242582

Published online: 03 Aug 2023.

INTERNATIONAL JOURNAL OF CIRCUMPOLAR HEALTH
2023, VOL. 82, 2242582
https://doi.org/10.1080/22423982.2023.2242582

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COVID-19 vaccine decision-making in remote Alaska between November 2020 and November 2021

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ABSTRACT

Vaccine hesitancy is an ongoing barrier to achieve sufficient COVID-19 vaccination coverage. Although there are many studies globally of vaccine hesitancy based on large survey samples, there are fewer in-depth qualitative studies that explore vaccine hesitancy and acceptance as a spectrum of decision-making. In this paper, we begin to describe vaccination decision-making among 58 adults living in remote Alaska based on three waves of online surveys and follow-up semi-structured interviews conducted between November 2020 and November 2021. The survey question of intention was not a predictor of adoption for about one third of the interviewees who were unvaccinated when they took the survey (n=12, 35%). Over half of all interviewees (n=37, 64%) had vaccine-related concerns, including 25 vaccinated individuals (representing 57% of vaccinated interviewees). Most interviewees reported that they learned about COVID-19 vaccines through interpersonal interactions (n=30, 52%) and/or a variety of media sources (n=29, 50%). The major facilitators of acceptance were trust in the information source (n=20, 48% of the 42 who responded), and learning from the experiences of family, friends, and the broader community (n=12, 29%). Further, trust and having a sense of agency appears to be important to interviewee decision-making, regardless of vaccination status and intention.

ARTICLE HISTORY
Received 16 November 2022
Revised 17 July 2023
Accepted 26 July 2023

KEYWORDS
COVID-19; vaccine hesitancy; vaccine acceptance; Alaska; Alaska native

Introduction

In early 2021 Alaska led the nation in per capita vaccinations [1], however, by early May 2021 vaccination rates began to plateau and by the end of 2022 the state had fallen to 33rd in the nation [2]. As of February 2023, 56.7% of Alaskan residents five years and older have completed their primary COVID-19 vaccination series (2 doses) [3]. Current vaccine coverage rates range widely by region, from 77% of residents over the age of 5 years in Interior, to 60–62% in Southeast Alaska and Anchorage to 41% in the Matanuska Susitna Valley and 40% North Slope [3].

It is widely believed that vaccine hesitancy is primary factor driving Alaska's plateau in COVID-19 vaccination coverage. The World Health Organization (WHO) has defined vaccine hesitancy as a "delay in acceptance or refusal of vaccination despite the availability of vaccination services". Vaccine hesitancy is complex and context-specific, varying across time, place, and vaccines [4]. According to the WHO working group, vaccine hesitancy occurs on a spectrum, from full acceptance/high demand, delay, and refusal of some vaccines, to complete refusal of all vaccines. Factors such as complacency (e.g. the belief that COVID-19 is not a high-risk disease), convenience (practical barriers to vaccination, such as access and affordability), and confidence (trust in safety and efficacy) influence whether an individual accepts or seeks vaccination [4].

Many scholars have quantitatively examined the associations between the determinants of vaccine hesitancy and either vaccine intention or adoption. As defined under the WHO Vaccine Hesitancy Determinants Matrix [4,5], determinant categories include contextual influences such as information sources, rumours, political affiliation, religiosity, health systems, and historical influences e.g [6–13], group- and individual influences such as patient-provider relationships [14], social norms [15], knowledge, attitudes and beliefs [7,16–18]. Among the category of vaccine- and vaccination-specific issues, scholars have identified concerns about vaccine safety and efficacy as well as a fear of side effects and long-term effects are commonly cited drivers of vaccine hesitance [14,19–26].

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Although widely used, some have criticised the term "vaccine hesitancy" for the lack of clear definition and measures, and for eliding the psychological and social determinants of acceptance and access [27–29]. The term "hesitancy" portrays a narrative associating vaccine uptake as an individual's lack of knowledge and/or attitudes often perceiving those who are hesitant as an "ignorant public" [30]. Mindful of these critiques, we use the term "vaccine decision-making" to refer to the complex and variable patterns across the spectrum of acceptance, hesitancy, and refusal.

Although there are many studies of vaccine hesitancy based on large survey samples, to date, there are few studies that use in-depth interviews to explore the complex decision-making across the vaccine hesitancy-acceptance spectrum. Our paper adds a qualitative study grounded in anthropology and public health perspectives to the relatively small literature on vaccine decision-making [13,16,31,32]. With this paper, we begin to characterise the complex decision-making around the initial COVID-19 vaccine series between November 2020 and November 2021 among Alaskans living off the road system. We first compare vaccine intention and subsequent adoption, and then examine concerns, information sources, facilitators, and motivations behind decisions on whether to get vaccinated. Our findings suggest that vaccine decision-making is an ongoing iterative process involving multiple information sources and interpersonal relationships, and during which one's intention may change over time.

Methods

We implemented three rounds of a statewide online survey to assess vaccine-related perceptions, as part of a larger project to examine the impacts of and responses to the COVID-19 pandemic in remote Alaska (communities located off the road system). The methods and results of these three surveys are reported in separate manuscripts [33,34]. Figure 1 shows the timeline of surveys and semi-structured interviews (SSI-1, SSI-2, and SSI-3) compared to COVID-19 vaccine availability and major COVID-19 related events in Alaska. Survey respondents had the option of self-selecting to participate in a follow-up semi-structured in-depth interview, which we conducted by phone or Zoom call in March 2021 for Survey 1 respondents, July 2021 for Survey 2 respondents, and late October through early November 2021 for Survey 3 respondents. All follow-up interviews occurred after the approval of COVID-19 vaccines for emergency use.

We used a purposeful sampling approach to select the participants for the semi-structured interviews based on survey results, and populations who were under-represented by our survey sample. Based on these criteria, we oversampled men, individuals who responded "definitely not" to all vaccine questions on the survey (including whether they had received and/or were planning to receive a vaccine),

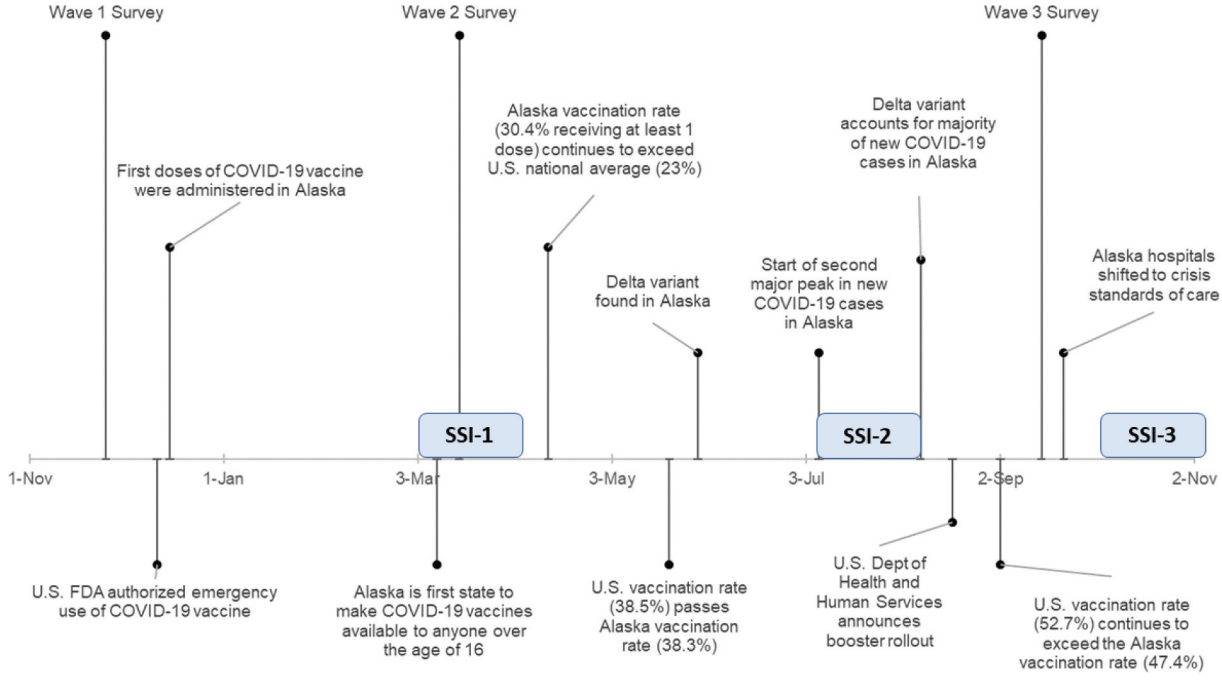

Figure 1. Timeline of surveys and semi-structured interviews (SSI-1, SSI-2, and SSI-3).

and respondents who said they or a family member had tested positive for COVID-19. For this paper, we chose to analyse responses of all interviewees, regardless of race/ethnicity to reflect the flows of information and interaction that occur within these multi-ethnic – but primarily Alaska Native – communities. We developed interview questions to explore topics enumerated by the surveys, as well as community-based concerns identified by our Elder advisor Cochran based on her interactions with community members and other Elders. Interviews lasted 30–60 minutes and covered how the pandemic had affected the interviewee and their family, food access, water access, coping strategies, COVID-19 vaccine perceptions and access, and personal reflections on community strengths and needs. We conducted informed verbal consent with participants prior to conducting each interview.

Interviews were analysed using MAXQDA coding software and Excel using a priori master themes based on categories developed in 2015 by the WHO SAGE Working Group on Vaccine Hesitancy [4], as well as those used more recently by [16,27,32], whose mixed methods are similar to our own. We then developed subthemes and additional master codes using invivo coding (using participants' actual words) and iterative inductive coding, first of specific questions and then through lexical searches for key words based on codes, as well as re-reading interview transcripts. We use quotation marks to designate invivo codes.

We approach individuals' vaccine decision-making as an ongoing process that occurs within broader social contexts. Key to our analysis are the conceptualisations of vaccine acceptance as a continuum [4] and the anthropological concept of biocommunicability [35,36], which posits that individuals engage with multiple information sources and explanatory models of disease [37,38]. Intention or willingness to vaccinate varies from high to low [16], with deliberation (or "watchful waiting") falling in the middle [32]. We understand vaccine decision-making to be affected by historical, political, economic, and social contexts, as well as lived experiences and emotions [12,13,27,37–40] We thus separate out the WHO "group and individual" category of determinants, and instead use categories as defined by the anthropologist Eric Wolf's four modes of power – individual, interpersonal, organisational, and structural – to account for the different levels of power that influence an individual's choices and behaviours [41].

Positionality statement

Our research team is led by a multi-ethnic group of Alaska Native and White researchers of mixed ancestral backgrounds, three of whom grew up in Alaska. Perhaps the biggest difference in our backgrounds compared to the population we surveyed and interviewed is that we reside in the largest city in Alaska. To account for that difference in perspective, as well as any additional cultural differences, we worked with Alaska Native and Non-Native leaders and service providers in remote communities to develop study methods, and to review interview and survey questions. All five individuals who conducted the interviews were women, and three were Alaska Native/American Indian interns involved in the Alaska Native Tribal Health Consortium Indigenous Research Program. Findings were first reviewed by the research team leaders, and then by anonymous reviewers and Alaska Native board members within the Alaska Native Tribal Health Association for both scientific rigour and cultural appropriateness.

Results

Demographics

We conducted in-depth follow-up interviews with 58 survey respondents, the majority of whom were female ($n = 36$, 62%), aged 25–54 years ($n = 35$, 61%) (Table 1). Most interviewees identified as AN/AI ($n = 32$, 55%) and ($n = 17$, 29%) identified as white. Ninety-three percent of our sample (54 individuals) had post-secondary education, including 24 (41%) who hold post-secondary degrees. A little over half ($n = 30$, 52%) of our interviewees were employed full time.

Vaccination intention versus adoption

Thirty-four (59%) interviewees were not vaccinated at the time they took the online survey. Table 2 shows the responses of these 34 interviewees to the survey question "Do you plan to receive a vaccine?", compared to their subsequent interview response to the question, "Are you vaccinated?" Based on their survey responses, we categorised these 34 unvaccinated interviewees into low-intention ($n = 12$, 21%; interviewees responded on the survey that they would "definitely not" or "probably not" get vaccinated), deliberating ($n = 13$, 22%; interviewees who responded that they would "maybe" get the vaccine or were "unsure"), and high-intention ($n = 9$, 16%; interviewees responded they would "definitely yes" or "probably" get vaccinated).

Table 1. Population Characteristics of Interviewees ($N = 58$).

Demographic	Number of participants	%
Gender		
Male	19	32%
Female	36	62%
Non-binary	3	5%
Age		
18–24	4	7%
25–54	35	61%
55–65	6	11%
65+	12	21%
Race		
African American	3	5%
Alaska Native or American Indian	32	55%
Asian	0	0
White	17	29%
Latino	0	0
Pacific Islander/Native Hawaiian	0	0
More than one race	6	11%
Education		
8th grade or less	0	0
Did not finish high school	2	3%
High school or GED	2	3%
Some college, Associate's, or vocational program	30	52%
College degree, post-graduate, or professional school	24	41%
Annual Income		
<$10,000	9	16%
$10,000–$29,999	15	26%
$30,000–$49,999	11	19%
$50,000–$69,999	6	11%
$70,000–$89,999	8	14%
$90,000 and over	9	16%
Employment		
Working (full-time, year-round)	30	52%
Working (part-time, year-round)	6	10%
Seasonal employment	2	3%
Unemployed (not due to COVID-19)	5	9%
Laid off or looking for work due to COVID-19	4	7%
Unable to work due to disability	4	7%
Homemaker	1	2%
Retired	4	7%
Student	1	2%

Note: *Two participants provided no answer for Age and Employment.

Table 2. Vaccination intention and status, survey versus interview responses among 34 interviewees who were unvaccinated at the time of the survey.

Survey: Do you plan to receive a vaccine? (n, % of interviewees)	Interview: Are you vaccinated?		
	Yes, vaccinated	No change, not fully vaccinated*	% change
Low intention (12, 21%)	4	8	33%
Deliberating (13, 22%)	8	5	62%
High intention (9, 16%)	9	0	100%
TOTALS ($N = 34$)	**21**	**13**	**62%**

Note: *Table does not include 24 interviewees who were vaccinated at the time they took the online survey.

However, the question of intention was not a predictor of eventual adoption for 12 (35%) of the 34 interviewees who were unvaccinated when they took the survey. Four (33%) low-intention interviewees and eight (62%) deliberating interviewees completed their initial vaccine series between when they answered the survey and when they participated in a follow-up interview.

Vaccine- and vaccination-related perceptions and concerns

We asked all interviewees, regardless of vaccination status or intention, whether they had any concerns about getting a COVID-19 vaccine. Over half of the interviewees ($n = 37$, 64%) had concerns, including 25 individuals who received a vaccine (representing 57% of vaccinated interviewees, Table 3). (We compare concerns between vaccinated and unvaccinated interviewees in a separate manuscript.) The majority of concerns pertained to safety ($n = 33$, 57%), especially the potential side effects ($n = 25$, 43%). A little over a quarter of the interviewees were concerned about the rushed production ($n = 15$, 26%). Thirteen (22%) individuals in our sample described distrusting the producers and/or motivations behind the vaccines' distribution. Other concerns included efficacy ($n = 7$, 12%) and maintaining bodily purity ($n = 7$, 12%). Twenty-one (36%) individuals reported having no concerns,

Table 3. Interviewee concerns related to getting a COVID-19 vaccine ($n = 58$).

Concerns	#	%	Definition/Example
Safety	**33**	**57%**	
Potential side effects	25	43%	Concerns related to potential side effects, including vulnerability while pregnant and/or breastfeeding, side effects for kids
Process-related: rushed production	15	26%	Concerns related to quick development timeline ("rushed production", "it's in the experimental stage"), desire for more research, new technology
Vaccine might give you COVID-19	1	2%	
Distrust	13	22%	Distrust in producers, political-economic motivations
Efficacy	7	12%	Uncertain/concerned about whether the shots work, and for how long
Spiritual: religion and body purity	7	12%	Concerned about introducing foreign substances into body
Unspecified	6	10%	
No concerns	21	36%	Interviewee had no concerns, in either survey or interview
Total interviews coded	58	100%	

Note: Codes are not mutually exclusive; segments may be coded with multiple codes.

including one unvaccinated individual who said they were not worried about getting COVID-19.

Information sources and facilitators

We asked two questions to understand how individuals made their decision as to whether they would get vaccinated against COVID-19: "Where did you learn about the vaccine to make your decision?" and "What made you/would make you feel confident and/or safe about getting a COVID vaccine?" (All interviews occurred after the FDA approved Pfizer, Moderna, and Johnson & Johnson vaccines for emergency use, but prior to the first FDA approval of a COVID-19 vaccine Pfizer, in August 2021). Interviewee's answers to these questions often overlapped. We therefore coded answers related to information sources as "Where: sources of information" (Table 4), and those that described the processes, including specific information and experiences, as "What made you/would make you feel confident/safe" (Table 5).

Table 4. Information sources interviewees used to decide whether to get a COVID-19 vaccine ($n = 58$).

Source of information	#	%
Media	**29**	**50%**
Social Media & Internet	18	**31%**
News	13	**22%**
Science Articles & Reports	4	**7%**
Radio	4	**7%**
Interpersonal interactions	**30**	**52%**
Healthcare providers	9	16%
Family & Friends	7	12%
Professional network	5	9%
Elders, Historical Memory	2	3%
"Word of mouth"	2	3%
Public Presentations & Advertising	**13**	**22%**
Independent Research (unspecified)	**11**	**19%**
Missing/Unclear	**6**	**10%**
Interviews coded	**58**	**100%**

Note: Codes are not mutually exclusive; segments may be coded with multiple codes.

Table 5. Facilitators to accepting a COVID-19 vaccine.

Theme	#	%*
Trust in information and source	**20**	**48%**
Trust in science (regardless of understanding)*	9	
Being able to ask questions of public health leaders, healthcare providers (non-family/friends)	4	
"Independent research"	4	
Others' experiences	**12**	**29%**
Pictures and stories of others' experiences, including political leaders and celebrities	5	
Family and friends' experiences	8	
Historical memory of prior infectious outbreaks/pandemics	3	
Personal experiences	**11**	**26%**
Positive environment where received shot	3	
Prior familiarity with shots	8	
Vaccine efficacy	**2**	**5%**
Total interviews coded**	**42**	**72%**

Note: Codes are not mutually exclusive; segments may be coded with multiple codes.

Results represent % of total interviews coded ($n = 42$, 72% of all interviews).

Interviewees reported drawing upon a multitude of sources to make their decision (see Table 4). A little over half ($n = 30$, 52%) of interviewees reported that the information they received through interpersonal interactions figured strongly into their decision-making, including healthcare providers ($n = 9$, 16%), family and friends ($n = 7$,12%), and interactions through their professional network ($n = 5$, 9). Half ($n = 29$, 50%) reported relying on some combination of media sources (including social media, news media, scientific reports, and radio). Five interviewees (9%) specifically mentioned speaking to family and friends who were healthcare providers and/or could explain the biological principles behind the vaccines. Two interviewees (3%) cited Elders and/or stories of the impacts of prior pandemics as motivating factors in their decision to receive a COVID-19 vaccine. About one fifth ($n = 11$, 19%) described receiving information from independent research and 13 (22%) individuals reported that they received information from public presentations and advertising.

Facilitators of confidence in vaccinated interviewees

Table 5 reports answers to the question "What made you feel confident and/or safe about getting a COVID vaccine?" as well as processes and specific information that made interviewees feel confident and/or safe about getting a COVID-19 vaccine as described by 42 of the 44 vaccinated interviewees. Twenty interviewees (48% of the 42 who responded) reported that they decided to get vaccinated because they trusted the source of the information they received, including nine individuals (21%) who mentioned specifically trusting the science behind the vaccine development and efficacy regardless of whether or not they understood the science. Agency and having a sense of control in information-gathering appears to be important to interviewees' sense of trust. Four interviewees (10%) described that what was particularly important to them for building trust and confidence was the ability to ask questions of public health leaders and healthcare providers, and feeling satisfied that their concerns were recognised, and questions were answered. Four interviewees (10%) noted that they did "independent research", which included consulting multiple media sources and scientific reports. A common theme throughout all of these answers is that the interviewees felt a level of control with regard to the information they received and the process of learning about the vaccines: they initiated conversations, they were able to ask questions, and/or they sought out information on their own.

Learning from the experiences of others was also a dominant theme ($n = 12$, 29%), including through pictures and stories disseminated through the media ($n = 5$, 12%), observing the experiences of friends and family ($n = 8$, 19%), and learning from Elders about the impacts of previous pandemics ($n = 3$, 7%). One quarter of interviewees ($n = 11$, 26%) described their personal experiences that increased their confidence, including a positive environment where they received their shots ($n = 3$, 7%) and prior familiarity with vaccines ($n = 8$, 19%).

Among the 14 (25%) interviewees who expressed a lack of confidence and/or perceived safety of the COVID-19 vaccines (including two vaccinated interviewees), the dominant themes were a desire for more time and information to make their decision ($n = 6$, 43% of those who responded), and "nothing" or "I don't know" ($n = 4$, 29%). (We present these data for comparison, though their numbers are too small to draw conclusions.)

Table 6. Vaccinated interviewees' motivations behind decision to get a COVID-19 vaccination ($N = 39$).

Category	Why got/will get vaccinated	N	% Vaccinated interviewees*
Individual		31	79%
	To lower own risk (infection, severe disease, death)	20	
	Freedom (including desire to travel and work)	14	
	Emotional wellbeing (to feel safe)	3	
Interpersonal		17	44%
	To protect others: kids, Elders, vulnerable household members, community	6	
Structural/ Institutional		15	38%
	Required (real, perceived, or anticipated requirement for work, travel, other)	4	
	Incentives	1	
	"It was free"	2	
Total interviews coded*		**39**	**67%**

Note: *38 of the 44 vaccinated interviewees respondent to the query of "why" they got vaccinated, and one unvaccinated high-intention mother described why she planned to complete her shots after giving birth. Results therefore represent 39 (67%) of all interviews.
*Codes are not mutually exclusive; segments may be coded with multiple codes.

Motivations to vaccinate

Table 6 shows the individual-, interpersonal-, and institutional-level motivations reported by 38 of 44 vaccinated interviewees (86%) as well as one high-intention unvaccinated individual. We included this high-intention interviewee because she reported that she would get vaccinated to protect family members, but that she was waiting because of concerns about potential side effects during her pregnancy. The majority of interviewees ($n = 31$, 79% of those who answered the question) were influenced by individual-level motivations, with the dominant theme in this category being individuals' perceptions of risks and benefits ($n = 20$, 51%). Fourteen (36%) of these individuals were motivated by a desire to travel (including three who were also motivated by travel-related requirements), and three (8%) got vaccinated to help their emotional well-being. Seventeen individuals (44%) reported interpersonal reasons including six interviewees (15%) who had the desire to protect others, particularly family, elders, and vulnerable household members. Fifteen individuals (38%) indicated structural reasons including four interviewees (10%) who reported they were motivated by current or potential institutional factors, such as employer and travel-related requirements.

Only 14 individuals (not included in Table 6) remained unvaccinated at the time of the interview. Almost all ($n = 12$, 86%) were concerned about safety,

including potential side effects. Fewer than half ($n = 6$, 43%) mentioned distrust in the pharmaceutical industry and/or government organisations involved in vaccine development and distribution, including distrust of incentives (referred to by one interviewee as "bribes"). Smaller themes included individual choice ($n = 4$, 29%), complacency or a lack of concern about infection ($n = 3$, 21%), religious beliefs or bodily purity ($n = 3$, 21%), and efficacy ($n = 2$, 14%).

Discussion

In this paper, we begin to describe vaccination decision-making among adults living in remote Alaska based on three waves of online surveys and follow-up semi-structured interviews conducted between November 2020 and November 2021. We explore decision-making around whether to get vaccinated against COVID-19 by focusing on initial interviewees' intention, vaccine-related perceptions and concerns, information sources used to make their decision, and facilitators of vaccination. Our findings add to studies indicating that vaccine decision-making is an ongoing iterative process of calculation [27] often involving emotions [13,31], perceptions, and engagement with a variety of trusted information sources [6], relationships [32,42,43], observations and personal experiences [13,16,32,42]. These occur within broader contexts, including individual, interpersonal, and organisational/structural levels of social power that influence individual choice and action [41].

About one third of interviewees who indicated low-intention or deliberation on their survey still completed their initial COVID-19 vaccine series. Thus, while there are clearly people who could be identified as vaccine "refusers" or "anti-vax", our results show that even those who respond that they will "definitely not" get vaccinated may change their minds at some future point [10,14,23,44]. Some scholars and public health practitioners refer to this group as the "moveable middle" [45], or "hesitant adopters" [23,42,43,46–48]. Trends in vaccine hesitancy and acceptance among our interviewees reflect our larger survey sample where we found that by September 2021, over 88% of respondents reported receiving two doses of a COVID-19 vaccine, in contrast to only 56% of respondents stating an intention to get vaccinated when asked pre-vaccine availability [33].

Vaccinated individuals may still have concerns about a vaccine and/or vaccination campaign. We asked interviewees whether they had concerns about getting a COVID-19 vaccine, regardless of their vaccine status or intention. Over half of interviewees ($n = 37$, 64%) had vaccine-related concerns, including 25 vaccinated individuals (representing 57% of vaccinated interviewees, Table 3). Other scholars have also found that individuals who accept or seek out vaccinations may still have concerns [23,32,47,49]. Interviewees' vaccine-related concerns are largely similar to those reported in the global literature on COVID-19 vaccine hesitancy e.g [16,32,50,51]: safety ($n = 33$, 57%), rushed production ($n = 15$, 26%), distrust in motivations behind production and/or distribution ($n = 13$, 22%), efficacy ($n = 7$, 12%), and religion and/or maintaining bodily purity ($n = 7$, 12%).

Our findings indicate that building vaccine confidence involves a combination of consistent messages disseminated through a variety of media sources, as well as interpersonal interactions and observations. The majority of interviewees reported that they learned about COVID-19 vaccines through interpersonal interactions ($n = 30$, 52%) and/or a variety of media sources ($n = 29$, 50%). The primary facilitators of interviewees' confidence about getting a COVID-19 vaccine were trust in the information source ($n = 20$, 48% of the 42 who responded). Learning from the experiences of family, friends, and the broader community (Elders, "word of mouth") was a common theme throughout conversations regarding what made interviewees feel confident ($n = 12$, 29%) as well as information sources. These findings provide evidence that supports the current CDC approach that encourages individuals to share their own stories of why they got a COVID-19 vaccine [45].

Indeed, trusting the source and/or understanding the information, as well as having a sense of agency [6,52] appears to be important to interviewee decision-making, regardless of vaccination status and intention. Trust may be more critical to vaccine acceptance than individual understanding of the science behind vaccines [51,53]. Only four interviewees indicated that they understood the scientific information regarding COVID-19 vaccines that was conveyed to them. Five vaccinated interviewees described that what was particularly important to them for building trust and confidence was the ability to ask questions of public health leaders and healthcare providers, and feeling satisfied that their concerns were recognised, and questions were answered. Four interviewees (both vaccinated and unvaccinated) noted that they did "independent research", which included consulting multiple media sources and scientific reports. A common theme throughout all of these answers is that the interviewees felt a level of control in where they received the information and the process of learning about the vaccines: they initiated conversations, they were able to ask

questions, and/or they sought out information on their own. With the exception of one interviewee, those who were still unvaccinated desired more information and more time to make their decisions.

Another dominant theme was learning from the experiences of others, including through pictures and stories disseminated through the media, observing the experiences of friends and family, and learning from Elders about the impacts of previous pandemics e.g [23,32,43]. Past and present personal experiences with shots were important to one quarter of interviewees. Only two of our interviewees cited the efficacy of the vaccine as a motivating factor. Interestingly, none of our low-intention or unvaccinated interviewees mentioned specific people nor information sources that influenced their decision not to get vaccinated. However, we may be able to explore this topic further with a larger sample size in the future.

Taken together, these findings add to evidence indicating that that vaccine decision-making is ongoing, iterative and relational, involving calculation [27], emotions, trust, personal experience and relationships [14,31,54–56]. In the hesitancy literature, vaccine-related concerns are often referred to as "misperceptions" or lack of education to be corrected by education campaigns. These assumptions contribute to a narrative of an "ignorant public" [30]. Yet our findings demonstrate that individuals engage with multiple sources of information and are actively making sense of that information.

Increasing vaccine acceptance therefore involves acknowledging concerns rather than approaching them as education deficits. Acknowledging patient concerns is particularly important to consider when working with marginalised populations, who may already be distrustful of institutions and/or individuals who represent the dominant population (e.g. middle class, White, etc.). Other studies conducted with Indigenous participants on vaccine acceptance indicate that institutional distrust is rooted in the colonial experience, including vaccine trials that used Indigenous peoples as guinea pigs and colonial policies that created inequities in housing, water- and food security, thus leading to greater vulnerability among Indigenous populations to infectious diseases [12,57–60]. At the same time, vaccine acceptance among Indigenous peoples may be rooted in a shared sense of responsibility to community and cultural preservation [61,62]. Understanding trust from individual community perspectives is therefore important.

Increasing vaccine acceptance in small, rural communities may be challenged by the dynamics of small town life: everyone knows each other, and maintaining cordial relationships and friendships can take precedence. This may be particularly true in a place like Alaska, where people rely on each other's help, particularly during the cold and dark winter months. In a recent presentation on vaccine hesitancy, the CEO of the Mat-Su Regional Health Corporation noted that healthcare workers were hiding the fact that they were vaccinated for fear of alienating other co-workers and community members [63].

One solution to these challenges of trust is to build upon existing relationships within communities, and to support community- and individual-led communication. For example, storytelling led by community members and trusted influencers may help address the issues related to institutional distrust. Involving individuals across different subjectivities, including – as indicated by one of our interviewees – political affiliations, may help increase vaccine confidence without threatening individuals' notions of subjectivity and identity. Importantly, this involves recognising that a public health message does not stand on its own: there is no authoritative knowledge about a pandemic, and the categories of vaccine acceptance and hesitancy (e.g. vaccine ready, vaccine refuser, and anti-vaxx) are subjectivities produced and reproduced through the circulation of competing explanatory models. Although individuals may learn about a novel pathogen from news media, their knowledge and risk perceptions are formed by a more complex field that includes top-down messaging, alternative explanations, interpersonal interactions, personal experiences, and observations [35].

The population included in this study is unique within the United States due to the remoteness of their communities and high proportion of Alaska Native participants, thus providing insight into this important but understudied population. Rural populations are often at higher risk and more vulnerable during disease outbreaks due to limited medical access and are often most difficult to reach for public health interventions.

In remote Alaska, access does not appear to have been a barrier to vaccine uptake, likely because of the small geographic size of these communities and the fact that the tribal health organisations had a strong vaccination infrastructure and expanded eligibility to non-Native residents. Although this uniqueness could limit generalisability of these data, similar findings are reported in the global literature on COVID-19 vaccine acceptance and perceptions, as well as qualitative studies on participant perceptions around the introduction of HPV and H1N1 vaccines.

This study has several limitations. Our sample is predominately female, Alaska Native individuals ages

25–54 years, and overwhelmingly educated with at least some post-secondary education. It therefore underrepresents men, other age groups and race/ethnicities, and education level. Our interviewee sample size does not enable in-depth analyses by vaccine status, age, gender, race/ethnicity, and other characteristics (such as occupation, pregnancy and/or breast-feeding). However, future analyses of our survey data will explore these differences with a greater sample size.

Importantly, although the majority of our interviewees were Alaska Native, the aggregated findings reported here should not be interpreted to represent all Alaska Native peoples. Interviewees were recruited through an online survey mechanism, thereby excluding those without internet or cell service. However, we do believe that this sample is largely representative of remote Alaskan communities within which vaccine-related perceptions would circulate and interpersonal interactions would occur. Future analyses should use a larger sample of in-depth interviews to examine differences in perceptions and decision-making by ethnicity and region.

Additionally, for this paper, we analysed interviews conducted during three different timeframes in 2021: February-March, July, and November. It is likely that overall acceptance and hesitancy changed during these three timeframes, although all occurred before the highly transmittable SARS-CoV-2 Omicron variants were identified in Alaska (combined with low vaccination coverage) causing cases to rise well above pre-vaccine levels. Future analyses with a greater sample size will enable more in-depth explorations of decision-making around COVID-19 vaccines, including characterising the motivations of different sub-groups and understanding how individuals move from being against vaccination and/or hesitant to trust and acceptance (sometimes referred to as "hesitant adopters", e.g [32,42,47,49].

To our knowledge, this is the first paper to report in-depth interview data on COVID-19 vaccine acceptance, hesitancy, and refusal among rural-residing Americans, as well as Alaska Native individuals. Our approach and interview questions have been informed by remote community leaders and service providers, mostly from Alaska Native perspectives, as well as scholarship from global health and medical anthropology. Our sample includes both Alaska Native and non-Native participants from across diverse socio-cultural regions of the state, which is reflective of the populations of remote Alaska.

We believe one of the main contributions of this study is that we are asking the same questions of each interviewee, regardless of vaccination status or intention. One of the limitations we found in the existing qualitative literature is a tendency to only ask unvaccinated individuals about their vaccine-related concerns and/or barriers to acceptance. Our findings show that vaccine-related concerns may exist across the hesitancy spectrum, even among those who are vaccinated. We suggest that research protocols should include questions regarding reasons for acceptance, hesitancy, and suggestions on how to build confidence around vaccines of all interviewees, regardless of vaccination status.

List of abbreviations

CDC	Centers for Disease Control and Prevention
COVID-19	Coronavirus disease 2019
SARS-CoV-2	Severe acute respiratory syndrome coronavirus 2
WHO	World Health Organization

Acknowledgments

This project would not be possible without the direction and input of individuals from across Alaska. Quyanaqpak to our interviewees, and to the community leaders and individuals who advised us on developing this study. Many thanks especially to the Northwest Arctic Borough Mayor Lucy Nelson and COVID-19 Taskforce, who allowed Eichelberger to sit in on meetings to learn about the pandemic's impacts and responses in remote Northwestern Alaska. We also thank the Alaska Native Tribal Health Consortium Indigenous Research Committee, and the Health Research Review Committee for their insightful comments and direction. Lastly, we want to express our gratitude to the late Paul Farmer, whose dedication to health equity and contributions to public health continue to inspire us.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the National Science Foundation (NSF) Office of Polar Programs under 2033192. The NSF had no role in the design of the study and collection, analysis, interpretation of data, nor in writing the manuscript.

Authors' contributions

Eichelberger led the analysis, literature review, and writing, based on master codes developed by Fried (reported in Hahn, et al 2022). Hansen conducted literature reviews and was a major contributor to the writing. Fried and Hansen calculated population characteristics. All authors assisted in interpretation

of data, paper framing, and writing the manuscript. All authors read, provided content, and approved the final manuscript.

Availability of data and materials

The datasets generated and/or analysed during the current study are not publicly available. Any release of data from this project must be formally requested from and approved by appropriate Tribal leadership.

Ethics approval and consent to participate

All study methods were reviewed and approved by the Alaska Area Institutional Review Board, as well as the Alaska Native Tribal Health Consortium Health Research Review Committee. We conducted informed verbal consent with participants prior to conducting each interview. This paper was reviewed by the Alaska Native Tribal Health Consortium Health Research Review Committee, who provided feedback that we incorporated into the final draft. All errors are our own.

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