



OPEN ACCESS

Where past meets present: Indigenous vaccine hesitancy in Saskatchewan

Patrick Sullivan,¹ Victor Starr,² Ethel Dubois,³ Alyssa Starr,¹ John Bosco Acharibasam,¹ Cari McIlduff¹

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/medhum-2022-012501>).

¹College of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

²Kihew Kawaskasit Health Services, Star Blanket Cree Nation, Saskatchewan, Canada

³Star Blanket Cree Nation, Star Blanket Cree Nation, Saskatchewan, Canada

Correspondence to

Mr Patrick Sullivan, College of Medicine, University of Saskatchewan, Saskatoon, SK S7N 5A2, Canada; patricknsullivan@gmail.com

Accepted 7 November 2022

Published Online First 5 January 2023

ABSTRACT

In Canada, colonisation, both historic and ongoing, increases Indigenous vaccine hesitancy and the threat posed by infectious diseases. This research investigated Indigenous vaccine hesitancy in a First Nation community in Saskatchewan, ways it can be overcome, and the influence of a colonial history as well as modernity. Research followed Indigenous research methodologies, a community-based participatory research design, and used mixed methods. Social media posts (interventions) were piloted on a community Facebook page in January and February (2022). These interventions tested different messaging techniques in a search for effective strategies. The analysis that followed compared the number of likes and views of the different techniques to each other, a control post, and community-developed posts implemented by the community's pandemic response team. At the end of the research, a sharing circle occurred and was followed by culturally appropriate data analysis (Nanâtawihowin Âcimowina Kika-Môshahkinikêhk Papisikîci-Itascikêwin Astâcikowina procedure). Results demonstrated the importance of exploring an Indigenous community's self-determined solution, at the very least, alongside the exploration of external solutions. Further, some sources of vaccine hesitancy, such as cultural barriers, can also be used to promote vaccine confidence. When attempting to overcome barriers, empathy is crucial as vaccine fears exist, and antivaccine groups are prepared to take advantage of empathetic failures. Additionally, the wider community has a powerful influence on vaccine confidence. Messaging, therefore, should avoid polarising vaccine-confident and vaccine-hesitant people to the point where the benefits of community influence are limited. Finally, you need to understand people and their beliefs to understand how to overcome hesitancy. To gain this understanding, there is no substitute for listening.

INTRODUCTION

Indigenous Peoples in Canada, including First Nations, Métis and Inuit Peoples, experience the detrimental impacts of both historic and ongoing forms of colonisation, including persistent health and economic inequalities (Reading and Wien 2009, 8). During the COVID-19 pandemic, overcrowded housing placed Indigenous Peoples at higher risk of transmitting infection while an inequitable burden of COVID-19-relevant comorbidities elevated their risk of severe infection (Bailie and Wayte 2006, 178; Reading and Wien 2009, 6; Charania and Tsuji 2012, 268; Mosby and Swidrovich 2021, 381–3).

However, throughout the pandemic, Indigenous communities used various self-led protective strategies in response to their increased risk (Power *et al.* 2020, 2739).

Heightened vaccine hesitancy among Indigenous Peoples stems from a long history of medical experimentation, forced or coerced sterilisation, residential school experiences, and unethical research by the very institutions who promote vaccination (Mosby and Swidrovich 2021, 381–3; Newman, Woodford, and Logie 2012, 91; Opel, Lo, and Peek 2021, 698–700). As Indigenous Peoples have many legitimate reasons to be hesitant of potentially life-saving vaccines (Mosby and Swidrovich 2021, 381–3), it is imperative to promote vaccine confidence within Indigenous communities. This research set out to address this imperative, bring an Indigenous voice into the controversial space surrounding COVID-19 vaccines (Priebe *et al.* 2022; Verd, Fernández-Bernabeu, and Cardo 2022) and better understand how to promote vaccine confidence within Indigenous communities in Saskatchewan. Indigenous research methodologies, a community-based participatory research (CBPR) design and mixed methods were adopted to guide this work.

This project engaged an Indigenous community, Star Blanket Cree Nation, in Saskatchewan, Canada to collaboratively develop a series of social media posts (interventions) to pilot on a community-run social media page. The posts were all approved by a community research advisory committee (CRAC) and followed behavioural insights (BI) and conspiracy theory strategies. These posts will be referred to as piloted posts or interventions, depending on context. Social media analytics were applied for a measurement of intervention effectiveness and so that different messaging strategies could be compared. As the project proceeded, a reflexive research approach allowed additional comparisons to be made between piloted posts and those developed entirely by community. At the project's completion, a sharing circle occurred where Indigenous community members contributed qualitative data that added depth to researcher understanding of Indigenous vaccine hesitancy.

Morning Star Lodge (MSL) is an Indigenous community-based health research lab. Founded in 2010, the lab has accumulated considerable experience supporting Indigenous communities through collaborative work. To support the often-argued most critical social determinant of Indigenous health, self-determination (Reading and Wien



© Author(s) (or their employer(s)) 2023. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Sullivan P, Starr V, Dubois E, *et al.* *Med Humanit* 2023;**49**:321–331.

2009, 24), MSL conducts no research about Indigenous Peoples without their direct and ongoing involvement. This involvement is also called for by the Canadian Institute of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC) and Social Sciences and Humanities Research Council (SSHRC) (CIHR, NSERC, and SSHRC 2019, 112). This requires reciprocal researcher-community relationships that create an ethical space where multiple ways of knowing and doing coexist, often resulting in a focus on strengths rather than deficits or vulnerabilities (Chambers 1983, 201). This ethical space enables the iterative synthesis of community expertise, Indigenous Knowledges and Western research.

The lab highlights local Indigenous voices by establishing CRACs composed of Elders, Knowledge Keepers, Community Research Assistants (CRAs), community members and people with lived experience. CRACs represent the voice of their community before, within and after research projects. Therefore, the requirements for CRAC membership are set by the communities that CRACs represent as no one beyond the community is in a position to determine who can represent the community's voice. Any community member who directly engages in research with the lab is considered a co-researcher, and will occasionally be referred to as such throughout this paper.

Prior to this project, the lab had already established a CRAC within the partnered community that, in this research, actively directed the lab on key decisions and promoted their community's self-determination. Beyond methodology, this CRAC continues to guide the research throughout knowledge mobilisation and this paper is only being made public after their contribution, feedback and approval. CRACs are paramount to all research undertaken by the lab given they can serve in an ethics exempt advisory role allowing community feedback, and self-determination, to be rapidly integrated into research.

Throughout the pandemic, Star Blanket Cree Nation's pandemic response team has been implementing a vaccination campaign. In the months between applying for funding and the commencement of research activities, this team found great success, with community members estimating vaccination rates exceeding 90%. Still, persistent refusers remained, and the CRAC guiding this research determined that the project would still prove valuable to their community.

LITERATURE REVIEW

This research had three related aims; promoting Indigenous COVID-19 vaccine confidence, bringing an Indigenous voice into the controversial space surrounding COVID-19 vaccines and understanding how to promote vaccine confidence within Indigenous communities in Saskatchewan. As co-researchers' perspectives represented the Indigenous voice this research was concerned with, the literature was deemed irrelevant on that front. The literature, however, was consulted in determining how to promote Indigenous COVID-19 vaccine confidence. Specifically, literature added understanding to *What needs to be said* and *How it needs to be said*.

This lab considers the perspectives of CRACs to be as, or more, valuable than those contained within the literature as they are experts in their lived experience and their community. Therefore, guidance from CRAC members regarding what needs to be said, and how, is included alongside the results of a literature review that was no more rapid than required by available resources. Within Indigenous health research, what we know, and how we come to know it, are both imperative (Castleden, Garvin, and First Nation 2008, 1394). All engagement with Indigenous

co-researchers met the community's definition of ethical and was supported by years of authentic relationship-building.

What needs to be said

The history Indigenous Peoples have been subjected to is unique and this is particularly relevant in discussions around vaccinations (Mosby and Swidrovich 2021, 381–3). It would be misguided for any intervention, social media or otherwise, to ignore historical influences on Indigenous vaccine confidence. That said, Indigenous Peoples exist within modern Canada, suggesting that, in addition to historical factors, they likely experience many of the contemporary factors experienced by non-Indigenous Canadians. To date, most research has focused on historical and contemporary influences largely in isolation (Mosby and Swidrovich 2021, 381–3; Muhajarine *et al.* 2021; Corbie-Smith 2021). Therefore, this research sought to advance academic understanding on both fronts, historical and contemporary, as well as potential interactions between the two. As a result, social media interventions were developed to reflect contemporary and emerging research while relying on CRAC feedback and edits to account for cultural, historical and local factors. Additional informal interviews were conducted when the CRAC deemed them necessary, and in these instances, CRAC members directed researchers towards appropriate interviewees.

The first step in developing the social media interventions was to consult academic literature and the CRAC on sources of COVID-19 vaccine hesitancy, Indigenous vaccine hesitancy and public health messaging strategies. In this section, results related to sources of hesitancy will be discussed while the following section will present messaging strategies. CRAC knowledge was gathered in multiple advisory meetings and thematically, but informally, organised by a single researcher before being reviewed and confirmed by additional researchers (online supplemental table S1).

Generally, a lack of desired knowledge is associated with increased hesitancy (Muhajarine *et al.* 2021, 6–9). As hesitancy does not necessarily mean refusal and could simply mean delaying vaccination (MacDonald and SAGE Working Group on Vaccine Hesitancy 2015, 4163), this is an entirely logical result as individuals may delay vaccination until they acquire the knowledge they feel is required for an informed decision. However, Charron, Gautier, and Jestin (2020) have observed that more time searching for knowledge was associated with increased hesitancy. The CRAC confirmed that community vaccination rates would benefit from increasing the accessibility of information their community deemed relevant.

The most extensively discussed community sources of vaccine hesitancy were grouped under a theme of medical misconceptions with subthemes including concerns about vaccine safety, efficacy and development timeline. As is often the case, CRAC observations of what is occurring in their own community are well supported by academic literature. Through content analysis of tweets, Griffith, Marani, and Monkman (2021, 5) found that safety was the most commonly cited concern. This is mirrored by the observations of Muhajarine *et al.* (2021, 6–9), 6–9) that individuals often attributed their hesitancy to insufficient clinical trials to evaluate safety, a lack of trust in the vaccine approval process, misgivings about vaccine safety and misconceptions.

While the CRAC did not explicitly discuss political or pharmaceutical mistrust, these sources of hesitancy are not uncommon (Griffith, Marani, and Monkman 2021, 5; Muhajarine *et al.* 2021, 6–9). Furthermore, the article by Mosby and Swidrovich (2021 381–3), 'Medical experimentation and the roots of

COVID-19 vaccine hesitancy among Indigenous Peoples in Canada', focuses heavily on lack of trust as an important source of Indigenous vaccine hesitancy. Therefore, trust in government and pharmaceutical companies appeared as a promising source of hesitancy to consider.

Muhajarine *et al.* (2021, 6–9), sampling more than 9000 Saskatchewan adults, found a very small minority citing religious grounds as the source of their hesitancy. While the CRAC did not mention religion by name, they did reference Traditions and Traditional healing practices as sources of hesitancy but also, a means to promote confidence.

Finally, beliefs that COVID-19 is mild or that natural immunity is sufficient are unsurprisingly observed sources of vaccine hesitancy (Griffith, Marani, and Monkman 2021, 5). Generally, hesitancy decreases as perceived threat to personal or community health increases (Muhajarine *et al.* 2021, 6–9). Again, this was echoed by CRAC members suggesting a worthy source of hesitancy for targeting.

In summary, promising sources of hesitancy to address with this project included the accessibility of information about COVID-19 variants and vaccines, medical misconceptions, Traditions and Traditional practices, and COVID-19 threat.

How it needs to be said

With the literature searched, and CRAC and co-researchers' perspectives on Indigenous COVID-19 vaccine hesitancy gathered through advisory meetings and informal interviews, the research moved to determine how those factors would be reflected in piloted social media posts. Given available resources would not allow for a systematic review; a narrowing of scope and rapid review were required. The narrowing of this scope was likely biased to some degree by researcher experience and the funder's preference for innovation. Regardless, the review seemed to point towards two categories of strategies: conspiracy theory tactics and BI.

Conspiracy theories have seemingly become more prevalent of late and many contain consistent narrative tactics (Odum 2021). As conspiracy theories have been cited as a major source of vaccine hesitancy (Muhajarine *et al.* 2021, 6–9), they certainly appear able to influence behaviour. Odum (2021, 62) found that traditional techniques of 'debunking' conspiracy theories are no longer appropriate as this debunking is easily integrated into the existing theory. Rather than engaging in the futile task of debunking conspiracy theories, this project sought to integrate the narrative tactics they employ.

The cognitive biases leveraged by BI can be used to influence decision-making and appear to possess some resistance to training (Kahneman 2013; Ballard 2019, 307–14). The conferring of a Nobel Prize for the similar 'Prospect Theory' (Nobel Prize 2002) may lend excitement to the application of BI in the realm of public health.

Anticipated regret is the first BI technique to be discussed and, in the context of vaccination, one could anticipate regretting the action of being vaccinated or anticipate regretting remaining unvaccinated (WHO 2020, 6–7). Perry *et al.* (2015, 17) noted that anticipated regret interventions suffer from decreased effectiveness if they are interpreted as emotional appeals. That said, Odum (2021, 62) noted the emotional focus of many conspiracy theories, and their success suggests that emotion may not always be a detriment. Anticipated regret seemed an appropriate strategy to apply to hesitancy-fuelling beliefs about COVID-19 severity and vaccine safety.

Reciprocity messaging has already proven highly effective in increasing organ donor registration and generally employs an 'if the shoe was on the other foot' argument (Perry *et al.* 2015, 18). Reciprocity messaging appeared well equipped to highlight the risk COVID-19 poses to the most vulnerable in the community and Perry *et al.* (2015, 18) suggest that reciprocity messaging may have the dual benefit of prompting anticipated regret.

The last BI technique considered was the *availability heuristic* (WHO 2020, 6). This heuristic creates room for individual risk assessments to be driven by personal experience, rumours or unreliable news rather than reliable statistics. If an individual can more readily retrieve examples of severe COVID-19 vaccine reactions than severe infections, they may judge severe vaccine reactions to be more common than severe infections. Given research suggests the opposite reality (Menachemi *et al.* 2021, 248; Public Health Agency of Canada 2021), this heuristic was selected for piloting.

As mentioned, traditional techniques of debunking conspiracy theories are no longer effective as this debunking is easily integrated into theories (Odum 2021, 62). One rationale for this integration is that mainstream media and the narratives they promote are controlled by the 'media deep state' (Odum 2021, 71). According to this belief, mainstream media cannot be trusted—even when they are relaying information from traditional sources of truth (Odum 2021, 71). When someone from a traditional source of truth supports a conspiracy theory, and is banished by their peers, this is taken as evidence that this person is a martyr who is being silenced (Odum 2021, 65). If the control of information is integrated into a conspiracy theory, any evidence that contradicts the theory can be easily dismissed. This strategy is referred to as the *victim motif* for the remainder of this paper.

Potentially preceding the pursuit of the alternative explanations offered by conspiracy theories, one may be hesitant due simply to a scepticism around political motives and mistrust of pharmaceutical companies (Griffith, Marani, and Monkman 2021, 5; Muhajarine *et al.* 2021, 6–9). It appears that this could be exacerbated within communities who have experienced historical breaches of trust, such as Indigenous communities in colonised countries (Mosby and Swidrovich 2021, 381–3). Odum (2021, 64) highlights that conspiracy theories allow an outlet to redirect frustrations one may have about their own government. That said, antivaccination advocates typically represent very well-organised entities with explicit financial, political or ideological agendas (Larson and Broniatowski 2021, 1289). Furthermore, automated social media bots have played a significant role in shaping conversations, spreading misinformation about COVID-19 and reducing vaccine confidence (Ferrara, Cresci, and Luceri 2020, 272; Himelein-Wachowiak *et al.* 2021, 4–5; Broniatowski *et al.* 2018, 1378–1384).

It appears misguided to attempt to convince a conspiracy theory believer that governments or pharmaceutical companies do not have ulterior motives. That said, antivaccine advocates do not have the selfless *motives* inferred from the victim motif (Odum 2021, 70). In highlighting this, confidence in antivaccine advocates may be reduced. Therefore, it may be possible to equalise trust that one may be applying differentially to government and conspiratorial antivaccine advocates. This strategy is referred to as 'motives' for the remainder of this paper.

Finally, Schoch-Spana *et al.* (2021, 6008) discuss the importance of *empathy* for reducing hesitancy and promoting vaccination—especially when legitimate concerns exist about vaccine safety, medical experimentation and inequalities (Schoch-Spana *et al.* 2021, 6008). Larson and Broniatowski (2021, 1289)

similarly recommend that communication with the hesitant be empathetic to avoid stigmatisation. The requirement for empathy to be highlighted as a solution may suggest that empathy is not the common or expected practice. Perhaps the empathetic failures of vaccine promoters can help explain the rise of conspiracy theories as Odum (2021, 62) noted their successful use of emotional or empathetic appeals. Interestingly, some authors have begun to discuss the role of *memes* in spreading conspiracy theories (Panchal and Jack 2022, 3).

METHODS

Indigenous research methodologies, a CBPR design and mixed methods were adopted to guide this work. However, as will become evident, it is an exaggeration to state that community participation was equal to that of researchers in every and all stages of the research, as would be the case with true CBPR (Castleden, Garvin, and First Nation 2008, 1394). For example, social media interventions were primarily developed by researchers with input, guidance and approval by community members. Further, in the development of the research plan, community involvement went no further than identifying the research priority and approving the workplan. Given the lab's established trusting relationships with the community, developing the plan *in a good way* (Flicker *et al.* 2015, 1149) was entrusted to the lab. While methods were selected based on experience with partnering Indigenous communities and the methods they often prefer, they were also influenced by researcher perceptions of funder preference.

The literature, including community knowledge, required as the foundation for pilot development has been discussed. That said, no discussion has occurred describing the conversion of *What Needs to Be Said* and *How It Needs To Be Said* into what ends up being said. The iterative process of converting these sources of information into pilot-ready interventions is discussed as a method in *Pilot development and implementation*. *Pilot development and implementation* will also describe the selection of an appropriate environment for piloting as well as the pilot schedule. The remainder of the Methods section will discuss the quantitative and qualitative methods employed in this study. Before those sections, a brief patient and public involvement statement is made.

Patient and public involvement

Co-researchers were first involved in the identification of the research priority. While engagement was limited throughout proposal writing, research implementation relied heavily on community guidance. Specific examples of co-researcher involvement are discussed throughout this article. When community was not directly involved in research decisions, previous experience was relied on for guidance and community approval was ultimately required. Before the project began, a CRAC agreed to partner and a research agreement was signed by the community's Chief. This article is only being made public after the approval of this CRAC and researchers continue to seek their guidance for additional knowledge mobilisation opportunities.

Pilot development and implementation

To reiterate previous sections, key sources of vaccine hesitancy included information inaccessibility, medical misconceptions, historical mistrust, Traditions and Traditional healing practices, and perceived COVID-19 threat. The messaging strategies selected for piloting included shifting anticipated regret, reciprocity messaging, correcting the availability heuristic,

undermining the victim motif, the use of memes, highlighting the questionable motives of antivaccine advocates (motives), and empathy. After informal interviews with co-researchers, it was determined that the project could use memes to address the victim motif.

To address informational accessibility, the lab met with community members to determine what information was needed. Next, the lab updated their COVID-19 resources to reflect community needs. These resources were developed to be informative, relevant and culturally safe, with illustrations that are familiar to Star Blanket's culture. Further, Star Blanket's pandemic response team circulated informational pamphlets, some of which were developed in partnership with the lab. To provide additional support, the lab circulated some of its own educational resources, developed in collaboration with local Indigenous communities.

With key sources of hesitancy and messaging strategies selected, the research drafted interventions. Next, the lab met with the partnered community's CRAC to present drafted interventions. An iterative process followed with CRAC members commenting on the interventions, their preferences and any edits required. When deemed necessary by the CRAC, additional perspectives were gathered through informal interviews. Relevant topics of this discussion are presented in the results section, as the understandings gathered through these conversations present interesting findings. In total, six interventions were developed, three investigating BI and three considering conspiracy theories. This number was chosen given it was the greatest number that was feasible within the project's timeline.

It is by including the CRAC in this process that researchers hoped relevant historical and cultural factors would be accounted for in the piloted social media posts, although CRAC input was not limited to these factors. Online supplemental table S2 lists social media posts in their initial drafts and final, CRAC-approved, forms. To reduce unnecessary information, the only initial drafts included are those that most closely resembled CRAC-approved posts; however, it should be noted that the CRAC was presented with several sample drafts for each strategy.

To pilot the CRAC-approved social media posts, the project needed to identify an appropriate location for posting. Supported by the CRAC, access was granted to a community-run Facebook page with high community engagement, and researchers were given permission to pilot interventions.

Interventions were posted every Monday, Wednesday and Friday at 13:00 local time until all posts had been made. A control post was included that simply stated, 'Call the (community health centre) at (phone number) to inquire about getting vaccinated'. This was included to provide a baseline measure on which the piloted interventions could be compared. The pilot period ran from 31 January 2022 to 14 February 2022, with each post having their likes, views and comments recorded 1 week after posting.

Quantitative methods

The purpose of piloting social media posts was to identify messaging strategies that were promising for vaccine promotion among Indigenous community members. Direct measures of the effect of each piloted technique on vaccination were well beyond the scope of this study. Therefore, likes, views and comments were gathered as an intermediate measure, with the assumption that more engagement meant the potential for more effective vaccination promotion.

With data gathered, the six piloted posts (reciprocity, anticipated regret, availability heuristic, memes and the victim motif,

motives and empathy) had their likes, views and comments compared with each other and to a control post. The averages of each measure for the pilot posts were compared with the performance of the control post while a regression analysis was performed to determine if the views, which contained the greatest variation among the three variables, followed a temporal trend.

As noted, this research was reflexive and sought to adjust its approach wherever feasible and beneficial, granted adjustments did not move the research away from its previously stated purposes. While gathering data on piloted posts, it began to appear as if posts made and developed by the community were outperforming piloted posts. Additionally, community feedback consistently included praise for the efforts and success of the local pandemic response team. Therefore, the six community-developed posts that most closely preceded the pilot period had their likes, views and comments recorded. These additional measures were gathered after the pilot period. Therefore, piloted posts had their data gathered a second time, while gathering the data for community-developed posts. While this resulted in community-developed posts having had a longer amount of time to be engaged, it appeared that this additional time made little difference. Comparisons between the 1 week data for piloted posts to the later-gathered data showed no changes in likes or comments and largely insignificant changes in views (one to three additional views). Therefore, comparisons between piloted posts and community-developed posts considered the averages of each group and was accompanied by a Mann-Whitney U test to compare the two groups (pilot and community).

Qualitative methods

At the end of the pilot, sharing circles were conducted with co-researchers. Sharing circles are similar to focus groups as researchers and community members gather information through group discussion (Berg 2001). While protocols may vary between communities, sharing circles consistently differ from focus groups in the sacred meaning they hold for many Indigenous cultures (Lavallée 2009, 29). For the circle conducted in this research, a CRA was engaged to gather community-specific protocols. Generally, sharing circles are used as a healing method where information, spirituality and emotionality are shared in an environment that is respectful, supportive and free of judgement (Restoule 2004, 10). In discussions around vaccine hesitancy and its sources, the supportive, respectful and healing aspects of the sharing circle made its use an obvious choice. While methods are proposed by the lab according to informational need and perceptions of funder preference, they are also chosen to respect, support and heal participating community members to the greatest extent achievable, and will only be implemented if approved by community.

For this research, the following questions were asked of co-researchers during the sharing circle: What are the reasons within your community that you think lead people to not get vaccinated? What do you think about the use of Traditional medicine in treating illnesses? Are there examples of misinformation that you've seen online and what do you think of them? What are the reasons you think people in your community choose to remain unvaccinated? What has helped community members overcome vaccine hesitancy? What do you think public health workers or organisations can do to help people who are unvaccinated choose to get vaccinated? And, finally, co-researchers were asked to freely comment on anything else they felt is relevant or to expand on their previous comments.

According to local sharing circle protocol, the facilitator is not supposed to influence contributions beyond simply stating, or restating, the original question. Therefore, co-researcher responses often provided new understandings or important context, without going so far as, for example, answering explicitly what has helped community members overcome hesitancy.

For this research, sharing circle data were analysed using Nanâtawihowin Âcimowina Kika-Môshahkinikêhk Papiskîci-Itascikêwin Astâcikowina (NAKPA). NAKPA, Cree for Medicine/Healing Stories Picked, Sorted, Stored, is an Indigenous qualitative analysis approach adapted from the collective consensual data analytical procedure (CCDAP) (Starblanket *et al.* 2019, 4). The CCDAP was developed to address the lack of community involvement in data analysis and holds the additional benefit of reducing the risk of bias that any single person could bring into research analysis (Bartlett *et al.* 2007, 2374).

NAKPA relies on group consensus and community input to organise data into themes (Starblanket *et al.* 2019, 7). Following NAKPA protocol, researchers and co-researchers collaboratively organise sharing circle responses thematically for each question. Following this, each 'theme' is given a name and considered a minor theme. Once this process has occurred for each question, the resulting minor themes are, again, combined thematically resulting in major themes. Therefore, major themes emerge based on responses from several different questions. It takes little experience analysing data with the NAKPA procedure to see clearly the potential pervasiveness of researcher bias in qualitative analysis sans panel format.

RESULTS

For this section, results will be presented plainly. Speculation, integration and reference to academic literature can be found in the discussion section.

Pilot discussions

The conversations that strengthened CRAC-approved interventions were too broad to be included here; however, notable feedback and observations warrant inclusion. First, there was a clear desire to integrate mention of an Elder praying over the vaccine. CRAC members commented that the vaccine is here to help their community and, like all good things, you should pray to, and thank, it. Further, there was clear refusal to include definitive statements about the safety of COVID-19 vaccines. 'The COVID-19 vaccines are safe' was strongly rejected however, 'the COVID-19 vaccines appear safe' or 'research is showing the COVID-19 vaccines are safe' were considered acceptable.

CRAC members made the interesting observation that reciprocity messaging had been, by far, the main messaging strategy they had encountered. They went on to explain that, at this stage in the pandemic (fall, 2021) reciprocity messaging had become stale, ineffective and disingenuous.

Importantly, and as mentioned, the CRAC made clear that their community had done an excellent job at promoting vaccination. While the causes for this success will be discussed, it is worth reiterating that the community still saw value in partnering in this research.

While the inclusion of discussions on CRAC input here does draw some line between what is worthy of inclusion and what is not, it should be noted that everything shared by CRACs is given the utmost respect. Still, brevity requires judgements to be made on which feedback is worthy of inclusion—and these judgements were made on the feedback's fit to the discussion section. For now, the final feedback to be included is that there

was an insistence that all messaging respect personal choice with empathy and without polarisation.

Social media analytics

In total, six new posts were piloted and accompanied by one control post. The analytics gathered one week after initial posting assessed how the piloted interventions performed in comparison to a control post. No control, pilot, or community-developed post had any comments and so, comments will not be discussed moving forward.

For piloted posts, 1 week after posting, the control received 0 likes and 51 views. Piloted posts averaged 0.6666 likes and 46.16666 views. Anticipated regret (two likes), reciprocity messaging (one like), and empathy (one like) received the most likes while anticipated regret (67 views), control (51 views), and reciprocity messaging (48 likes) were the most-viewed. While empathy performed relatively well in likes, it only achieved 39 views. That said, the empathy post was made towards the end of the pilot period, while the control post was made near the beginning, and pilot views generally decreased over time ($R^2 = 0.6782582938$).

From January 31, the start of the pilot period, the six most recent posts made by community members that explicitly nudge individuals towards vaccination were made on January 5, 6, 10, 21, 25, and 27th. On March 10th of the same year, these posts had an average of 2.3333 likes, and 64.6666 views. In comparison, the piloted posts, as of March 10th, averaged 0.6666 likes and 48 views.

Mann Whitney U Tests were performed to compare the likes and views of community-developed posts to those of piloted posts, using the data gathered on March 10th. The small sample sizes and inconsistent pilot length weaken this analysis; however, the community posts performed better in views, at a 5% level of significance, and in likes, at a 10% level of significance.

Online supplemental table S3 can be referenced for data collected on the likes and views of community-developed and piloted posts, as of March 10th.

Sharing circle and NAKPA

Following several NAKPA panel sessions, with experienced and early career researchers, CRAC members, and CRAs, six major themes emerged including: culture, fear, government COVID-19 responses, information consumption and exposure, community influence, and appeal of the vaccine hesitant community.

Online supplemental table S4 contains all major themes and the minor themes supporting them.

DISCUSSION

The discussion will begin with the piloted social media interventions, their effectiveness, and the community-developed posts. The next subsection will focus on pilot development discussions, informal interviews, and the sharing circle. When determined appropriate to do so, reference to quantitative results will be integrated into the discussion on qualitative findings.

Social media analytics

Among piloted posts and the control, the messaging strategies receiving the most likes included anticipated regret, reciprocity messaging and empathy while the most viewed were anticipated regret, the control and reciprocity messaging. While this does seem to suggest that anticipated regret and reciprocity messaging are worthy of future investigation, a closer look lessens the significance of their relative performance.

For likes, the range of results was only two, with the second most liked post only receiving one more like than the least. There are too many reasons for a variation of this size to come close to suggesting, with any confidence, that the difference was due to pilot effectiveness. Furthermore, pilot views generally decreased over time, with those posts made later in the pilot period receiving fewer views ($R^2 = 0.6782582938$). Again, there are a wide variety of reasons for this decrease that make any kind of conclusion inappropriate. For example, it is possible that later posts were of lower quality. It is also possible that poor performance early in the pilot period interacted with Facebook's algorithm in a manner where subsequent posts were not made visible to the same degree. Within this research, there were no measures designed to evaluate such possibilities.

Over time, the poor pilot performance became clear. Accompanying this, at nearly every interaction with the CRAC, there was mention of how effectively the community and its pandemic response team had been promoting vaccination. This spurred researchers to perform the additional comparison between piloted social media posts and the posts developed entirely by the community. While these comparisons suffer statistically from the small sample size and inconsistent pilot length, the results are still noteworthy. Specifically, the community posts (2.3333 likes and 64.6666 views) certainly appeared to achieve higher engagement than the piloted posts (0.6666 likes and 48 views). Mann-Whitney U tests suggest that the difference in views and likes was statistically significant, at 5% and 10% confidence levels, respectively.

Despite the study's reflexive nature, its initial design still posed limits to flexibility. Why community posts did better than piloted posts, and how the community found success in overcoming vaccine hesitancy, were not sufficiently integrated into the initial study design to have led to satisfying answers. This points to an important note for researching with Indigenous Peoples. Specifically, when searching for 'innovative' solutions, or piloting solutions in general, the first question should be, what does community plan to do, or what are they already doing?

As mentioned, self-determination is often argued as the most important social determinant of Indigenous health (Reading and Wien 2009, 24). The solutions intended by an Indigenous community are self-determined and, therefore, should be explored before, or at least alongside, any piloted external solutions. If this study had placed a greater focus on the self-determined solutions of the community, rather than potentially 'innovative' strategies, the results would have allowed more valuable answers to how the community found success.

Despite the methodological oversight, the relative performance of community-developed and piloted social media posts does have footing in academic literature. In promoting vaccines in marginalised communities, Larson and Broniatowski (2021, 1289) suggest leveraging established relationships, while the WHO (2020) suggests trusted messengers. Muhajarine *et al.* (2021, 12–15) discuss working with organisations with established community relationships and Schoch-Spana *et al.* (2021, 6008) add, ideally, to use an entity whose only interests are community health and well-being. Finally, community-based promotion and delivery are generally considered as beneficial (Muhajarine *et al.* 2021, 12–15). Star Blanket's pandemic response team has existing, trusted relationships with their community; their only interest is the community's health and well-being and they are certainly community-based in their promotion and delivery.

Here, it is worth highlighting that the lab has trusting relationships with several members of partnered community, and

is constantly walking the long road to these relationships with additional community members. That said, these relationships very likely do not translate to the whole community. Even less likely would be for these relationships to translate into the anonymous posting of pilot interventions on the identified platform.

As this discussion concludes, it may be worth stressing that researchers can't allow themselves to be distracted by a desire for innovation when there are proven strategies in place. Often, Indigenous communities' biggest need is not for some external innovative solution given Indigenous-led movements are recognised to advance health equity (Allen et al. 2020, 208). Therefore, to better understand how to support Indigenous health, innovative solutions should be only considered after a thorough investigation of a community's self-determined solutions. Even then, community voice should be more present in defining innovation than was the case with this research.

Had this research set out to, at least in addition to innovative strategies, explore the community's strategy, the result would have provided a greater understanding of what works. An example of the value of research whose primary focus is understanding the success of an Indigenous community's pandemic response can be found in the culturally guided case study of an urban marae-led response to COVID-19 by Davies *et al.* (2022).

Pilot discussions, sharing circle and NAKPA

For this discussion, subsections depict the six major themes identified in NAKPA analysis. The major themes are presented in an order that allows for logical transitions between sections. Therefore, headings are primarily included to cue the reader of the theme being discussed.

Culture

The major theme of culture, perhaps unsurprisingly, presented a complex web of understandings. While colonisation has limited the transmission of knowledge related to Traditional Medicine picking, harvesting and using, many who possess this knowledge put it to use frequently. Included in this knowledge is that the efficacy of these medicines is dependent on one's belief in them. One CRAC member explained how choosing to get vaccinated is paramount to doubting the Medicines gifted by the Creator. Related to this, a co-researcher described the fear they felt about mixing Traditional and Western medicines.

For several co-researchers, belief in Traditional Medicines emerged organically and easily from their first-hand experiences with Elders. According to co-researchers, these Elders have thrived while relying almost exclusively on Traditional Medicines, rather than the 'temporary fix' of modern medicine which often includes 'taking fifteen, twenty pills a day'. Further discussion included examples where Western medicine has claimed ownership over Traditional Medicines.

According to co-researchers, a major reason people choose to remain unvaccinated, or delay vaccination, is belief. Specifically, vaccine-hesitant people often have firm beliefs in Traditional ways. This belief was often accompanied by a lack of trust in COVID-19 vaccines' safety or efficacy. Interestingly, hesitancy due to historical breaches of trust were not mentioned. That being said, Muhajarine *et al.* (2021, 12–15) did note that an individual's reported reason for remaining unvaccinated may not be their true underlying reason. In these contexts, this may mean that historical breaches of trust are the underlying cause; however, individuals report this as a lack of trust in the vaccines.

Culture, including Traditional Medicines, certainly appears to be a reason some choose to remain unvaccinated. This is

complicated by the spiritual implications of vaccination being felt as equivalent to doubting the Creator and their Medicines. However, as mentioned, culture can also allow people to overcome their hesitancy. Praying to, or over, the vaccine was mentioned multiple times as the catalyst to overcoming hesitancy. This was discussed as beneficial at the community level, with a prominent Elder praying over the vaccine supply, as well as the individual level, where co-researchers prayed to the vaccine before their own vaccination.

For anyone looking to promote vaccination, especially when cultural differences exist, it appears valuable to engage community members to see where culture may heighten hesitancy, but also, where it may be leveraged to the benefit of vaccine promotion. Importantly, if this engagement is with a marginalised community, cultural safety needs to be a serious consideration before any such conversations occur.

Given that Traditional Medicines require belief, and vaccinating can be seen as a suspension of this belief, vaccine mandates enter ethically muddy waters. In this view, vaccination mandates could be seen as assimilative in nature, punishing those who refuse to doubt the Creator and vaccinate, and rewarding those who suspend their beliefs with full participation in society. This is especially problematic as, according to the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (United Nations 2007, 18), Indigenous Peoples have the right to their Traditional Medicines. However, as discussed, many Indigenous Peoples involved in this research see the dichotomy between belief in the Creator and vaccination to be a false one. In these contexts, the spiritual implications of vaccination are very individual. Still, those promoting vaccination can certainly risk doing harm if unaware of the beliefs of the individual they are engaging.

As this paper was being drafted, edited and refined, one coauthor from Star Blanket Cree Nation made an additional and highly relevant observation. Specifically, the line between Traditional Medicines and Western medicines is anything but firmly defined. Many Western medicines rely heavily, or at least in part, on Traditional Medicines. For example, the active ingredient in aspirin was identified, and used, by Indigenous Peoples long before it entered the realm of Western medicine. In this discussion, it was highlighted that knowledge of vaccine ingredients, especially when they include Traditional Medicines or other *natural* ingredients, may help many overcome their hesitancy.

Fear

Fear was another major theme that, like culture, can be a reason to refuse, or accept, vaccination. Mentioned fears included not knowing what was in the vaccines and whether the vaccine would make one sick. One co-researcher recounted a friend who, being raised on Traditional Medicines, was 'scared of basically being forced to put that (vaccine) in their body'. That said, seeing those who have always had a strong preference for Traditional Medicines get vaccinated led some to re-evaluate their assessment of COVID-19 risk and vaccinate themselves. Additional vaccination-spurring fears included seeing community members fall ill and reports of hospitalisations and ventilations.

When someone who is vaccinated falls ill, one Elder explained how there are experiences of grief and devastation, especially if the infected is known to be vulnerable. The Elder explained that, at these moments, individuals are thrown into their faith and beliefs, finding comfort in their Traditions. Additionally, a subconscious fear of COVID-19 was described and accompanied by the pervasive question of whether infection will result

in death. Again, the Elder explained that, in the face of these emotions, individuals will do all that they can to protect their health. For many, this means a holistic approach that likely includes Traditional Medicines.

CRAC members made clear that any social media posts must be empathetic and respectful to all. The importance of empathetic communication with the hesitant is recognised within academia (Schoch-Spana *et al.* 2021, 6008; Larson and Broniatowski 2021, 1289). Empathy being mentioned as a requirement of social media messaging may suggest that, contrary to literature, messaging had not always been empathetic. If this is the case, it is difficult to say that hesitancy-fuelling fears were adequately being addressed.

As previously mentioned, it is recommended to empathise with legitimate concerns around vaccine safety (Schoch-Spana *et al.* 2021, 6008). On this note, the CRAC's rejection of any definitive statements on vaccine safety is worthy of expansion. Here, the question of what qualifies a concern as 'legitimate' is highly relevant. Additional questions worthy of investigation include how, exactly, the target population defines the word 'safe' in reference to vaccines. For example, do severe, but rare, side effects render a given vaccine beyond the public's definition of safety? Or, who defines what concerns are legitimate, and worthy of empathy. According to this research and the academically supported importance of empathetic communication, it appears that any concern is legitimate and should be met with empathy.

On the topic of fear, one author from Star Blanket discussed its relationship with power. In the context of COVID-19 vaccination, they discussed how fear can be used to control people's decision to vaccinate. That said, they continued that the younger generation is resistant to this approach, standing firm in their beliefs and rejecting fear-based tactics. The discussion speculated on how this may have contributed to an increase in vaccine hesitancy in comparison to previous years. An analysis of how fear was used to promote vaccination, and the effect these approaches had on various demographic groups, may help strengthen future vaccine promotion campaigns.

Community influence

Community vaccination rates and clinics, reciprocity, the influence of Kin and social interactions were minor themes of community influence. Within the partnered community, during the sharing circle, co-researchers had difficulties recalling unvaccinated community members, believing vaccination rates exceeded 90%. While there were many explanations offered for this success, co-researchers repeatedly spoke highly of the community's pandemic response team and the local clinics they organised.

Beyond formal and organised vaccine promoting efforts, seeing relatives and friends get vaccinated spurred some to overcome their hesitancy. Reciprocity emerged as a minor theme with one co-researcher stating that the clear message was, 'the vaccines help and if you care, if you care for your fellow loved ones,... you'd get it'. This was especially persuasive for one co-researcher who said, 'a lot of Elders, so my mōsom, my kōhkom, I got it for them as well too, to be safe around them, and for my nieces, and my nephews'. Other co-researchers, without providing as much detail, said that having high-risk relatives and friends influenced their decision to vaccinate.

The responses of co-researchers made clear the importance of community for creating an environment that promotes vaccine confidence. In reference to how hesitancy can be overcome, one

co-researcher stated, 'definitely our own community has helped each other... by debunking the fear' while another co-researcher partially attributed their community's success to, 'caring about other people... Caring about the community'. The CRAC's insistence that any piloted interventions avoid polarisation takes on new meaning given the power of the community in promoting vaccination. As vaccinated members of the community influence the decisions of many who are hesitant, it appears highly important to ensure that messaging does not polarise these two groups beyond the point of respectful discussion.

Appeal of vaccine-hesitant community

The local community was not the only one making its influence felt during this pandemic. There was mention of people simply wanting to be a part of the anti-vaxx community. Highly relevant to this discussion was the mention that, to help people overcome hesitancy, you really need to listen to them and understand their beliefs. Again, empathy is brought into the conversation.

When attempting to change someone's opinion, listening to what that opinion is seems a logical place to start. Online, the average size of anti-vaccine groups (clusters) is smaller than that of pro-vaccine alternatives (Johnson *et al.* 2020, 231). As a result, anti-vaccine clusters are more dispersed and provide a larger number of sites for engagement than pro-vaccine clusters (Johnson *et al.* 2020, 231). Therefore, anti-vaccine clusters entangle themselves within the network of the vaccine hesitant in a manner that pro-vaccine clusters cannot (Johnson *et al.* 2020, 231). These differences, in the context of co-researchers' comments on empathy, listening and vaccine safety, may help explain why, online, antivaccine groups recruit the undecided much faster than pro-vaccine groups (Johnson *et al.* 2020, 231). It appears that vaccine promoters may have lessons left to learn from the antivaccine community.

Government COVID-19 responses

Government COVID-19 responses certainly influenced some towards vaccinations. Mentioned reasons for vaccination included to work, travel, escape isolation and enter public spaces. According to one co-researcher, the isolation of physical distancing 'took its toll on our people to get the, to get their vaccine'. Another described a friend who, being largely Traditional, felt fear when they felt forced to vaccinate. A third has family and attends Ceremony in the USA and required vaccination to enter the country.

At the time of this circle, Saskatchewan was beginning to lift many of the public health measures it had been enforcing throughout the majority of the pandemic. This created some anxiety as, according to co-researchers, previous lifting of restrictions had been accompanied by rising case numbers and hospitalisations. Included in this was concern for front-line workers, given the highly stressful conditions they had been enduring for well over a year. Ultimately, despite the government measures in place, co-researchers stressed that they would continue to guide their behaviour by personal risk assessments. One co-researcher stated they would continue to mask, physically distance and sanitise regardless of the lifting of COVID-19 restrictions.

It is worth mentioning that, co-researchers' personal risk assessments appeared far more focused on local circumstances than the actions of the Federal or provincial governments. The decisions of the local Council and pandemic response team, who had trusted relations with the community, appeared far more relevant than the guidelines of other governments.

Information exposure and consumption

Some co-researchers reported seeing a lot of misinformation, especially at the beginning of the pandemic. Other co-researchers reported seeing very little, however, what they did see most often discussed COVID-19 vaccines.

Vaccine ingredients were a common topic for misinformation, leaving many unsure or fearful. Co-researchers further discussed misinformation about the vaccine development timeline, stressing that some felt it was rushed or that the government was using its people as guinea pigs. Additional misinformation about the vaccines included red herrings: comparing the rapid development of COVID-19 vaccines to previous difficulties developing a vaccine for the 2003 Severe Acute Respiratory Syndrome outbreak or acquired immunodeficiency syndrome. This may have contributed to the persisting vaccine refusers, few as they may be, who remain distrustful of the science.

Consistent with the literature (Muhajarine *et al.* 2021, 6–9), potential misconceptions about COVID-19 severity were discussed. One co-researcher recounted hearing, ‘it’s not that bad... if you’re young, you’ll beat it’. That said, when COVID-19 cases within the community increased, co-researchers reported that so too did the virus’ perceived severity.

As governments first implemented public health restrictions and mandates, co-researchers reported seeing many posts about infringements to personal freedom. As time passed, it appeared that these posts decreased in frequency. Perhaps this is due to COVID-19 entering the community and increasing the perceived threat of COVID-19.

As COVID-19 public health measures appeared to make a tentatively permanent decrease in severity (January 2022), co-researchers mentioned that many saw no further need for vaccination or boosters. This was accompanied by concerns about changes in COVID-19 data reporting on the news. Co-researchers often relied on personal discernment to guide their actions. Therefore, as case reporting moved from daily to weekly, co-researchers reported uncertainty and anxiety.

When asked what public health organisations can do to overcome misinformation and promote vaccination, one co-researcher responded, ‘that’s kind of a... tricky question... public health workers and some organisations... they both give out positive information and misleading information’ and, ‘there may be a lot of doctors or healthcare workers who are not vaccinated’. As has often been the case, this observation is consistent with the literature (Larson, Lin, and Goble 2022, 1417).

Despite these challenges, co-researchers discussed ways information could be used to promote vaccination. From their experience, educational resources are certainly helpful. On multiple occasions, co-researchers talked about the positive effect of educational pamphlets and pandemic response kits, provided by the community’s pandemic response team and developed in partnership with the lab. There was specific mention of information about vaccine ingredients, and this relates to previous conversations about uncertainty in this area.

As mentioned, statistics and medical information are valuable. That said, two comments point towards an important understanding, the first being that, ‘people resonate with people, not with data’, and the second being, ‘yeah they can hear about it, whatever, but I think they need to... really physically kind of see something’. This appears related to the effect of first-hand accounts and expert reports, where audiences are generally conditioned to interpret these as accurate given the speaker was ‘there when it happened’ (Usher 2020, 250; Odum 2021, 70). Further, an extensively discussed potential solution included a

short documentary, potentially contrasting the lived experience of COVID-19 in a vaccinated person with that of someone who was not vaccinated.

Before concluding this discussion, CRAC comments on the staleness of reciprocity messaging will be discussed. It seems reasonable that different individuals, with different sources of hesitancy, would find different messaging most persuasive. That being said, dynamic factors also appear to strengthen or weaken the persuasiveness of strategies. For example, COVID-19 infection proximity appeared to interact with reciprocity messaging, with closer proximity increasing the strategy’s persuasiveness.

Overcoming vaccine hesitancy appears far too complex and individual to generate a universally effective vaccine promotion campaign. What works for one, may not for another, and what works at one time, may fail later. When it comes to helping someone overcome vaccine hesitancy, perhaps the only consistent ‘best practice’ is that, ‘you really just have to listen to them, understand their... beliefs’.

LIMITATIONS

Small sample size and inconsistent pilot length limited the strength of quantitative analysis and any conclusions that could have followed. Further, this study suffered by placing insufficient focus on investigating the community-based solution that, anecdotally, was highly successful in the challenging task of promoting vaccine confidence. Had this research set out explicitly to learn from Star Blanket Cree Nation’s success, rather than testing out potential alternative solutions, a far greater understanding of how to replicate the community’s success would have followed. Finally, Indigenous Peoples are incredibly diverse, limiting the generalisability of this research. While there would be little risk in listening and being empathetic, one should be cautious if applying findings from one Indigenous community to another.

CONCLUSION

In conclusion, research seeking to better understand how to promote Indigenous health must explore self-determined solutions, at the very least, alongside any ‘innovative’ solutions. Despite overlooking this important fact, this research still resulted in valuable findings. Consistent with the literature, community-based vaccine promotion can overcome many barriers to vaccine confidence. Some of these barriers, such as culture, can also be used to promote confidence. When attempting to overcome barriers, empathy is crucial as vaccine fears exist, and antivaccine groups are prepared to take advantage of empathetic failures. Additionally, the wider community has a powerful influence on vaccine confidence. Messaging, therefore, should avoid polarising vaccine-confident and vaccine-hesitant people to the point where the benefits of community influence are limited. Finally, you need to understand people and their beliefs to understand how to overcome hesitancy. To gain this understanding, there is no substitute for simply listening.

Correction notice This article has been corrected since it was published Online First. Due to a retracted paper in the bibliography the paragraph, ‘Appeal of vaccine-hesitant community’, has been amended accordingly. The ‘Provenance and peer review’ statement has also been edited.

Acknowledgements We want to acknowledge all those from the community who have, or still are, suffering from the effects of COVID-19. We want to acknowledge all the loss, hardship and suffering that has, and is, occurring. Our thoughts and prayers are yours. Beyond this, we want to thank all those from Star Blanket Cree Nation who met with the research team, shared their perspectives and added value to this research. Thank you to Kaleigh Starblanket, Vicky Desnomie and Rhea Starr for your contributions to the design and execution of this research - your insights helped

form the foundation of what is reported in this paper. Hiy hiy. Thank you Meghan Chapados for your work navigating the complexities and barriers that stand opposed to work done in this way. Further, we must acknowledge the tireless dedication of the community's pandemic response team - there is much left to learn from the successful vaccination campaign you led. Additionally, we acknowledge past health representatives for their pandemic preparedness work. Together, past and present health workers in the community contributed to a responsive, holistic and successful community-driven pandemic response. The entire community contributed to the success of this response; from the Elders who predicted this pandemic decades ago, to the kindness carried in the eyes of all community members, we acknowledge and thank you. To those who shared their personal protective equipment or Traditional Medicines, you also deserve to be recognized and thanked. Finally, we thank the Vaccine Confidence Fund, Facebook, Merck & Co. and Global Impact for funding and supporting this work. Virtually, this project was largely conducted from Nova Scotia on the lands of the Peace and Friendship treaties & the traditional home of the Mi'kmaq Peoples. Physically, this project occurred in the traditional, and current, lands of Star Blanket Cree Nation - land that rests within Treaty 4 territory.

Contributors VS & KED deserve special recognition for the local and cultural knowledge they brought into this paper. JBA provided much-needed support during quantitative analysis. AS contributed substance to this research during informal interviews, influenced the design of piloted interventions, and alongside VS, provided valuable edits to the paper. CM manages the lab expertfully, and is an experienced academic, providing valuable insight and feedback throughout this paper. PS is the guarantor, co-leading the project and being chiefly responsible for reporting and publishing.

Funding This research was funded by the Vaccine Confidence Fund, sponsored by Facebook and Merck Sharp & Dohme, and administered by Global Impact.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board. The application was approved under the ID 3047. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. All the data informing this project ultimately belongs to the community who consented to its collection, contributed its substance and approved its use in this paper. Decisions on any subsequent use of this data, therefore, lie firmly within the autonomy of the community. Via the corresponding author, proposals for use or inspection can be presented to community leadership for their deliberation, upon reasonable request.

Supplemental material This content has been supplied by the author(s). It has not been vetted by BMJ Publishing Group Limited (BMJ) and may not have been peer-reviewed. Any opinions or recommendations discussed are solely those of the author(s) and are not endorsed by BMJ. BMJ disclaims all liability and responsibility arising from any reliance placed on the content. Where the content includes any translated material, BMJ does not warrant the accuracy and reliability of the translations (including but not limited to local regulations, clinical guidelines, terminology, drug names and drug dosages), and is not responsible for any error and/or omissions arising from translation and adaptation or otherwise.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

BIBLIOGRAPHY

Allen, L., A. Hatala, S. Ijaz, E. D. Courchene, and E. B. Bushie. 2020. "Indigenous-Led Health Care Partnerships in Canada." *CMAJ* 192 (9): E208–16.

Baillie, R. S., and K. J. Wayte. 2006. "Housing and Health in Indigenous Communities: Key Issues for Housing and Health Improvement in Remote Aboriginal and Torres Strait Islander Communities." *The Australian Journal of Rural Health* 14 (5): 178–83.

Ballard, A. 2019. "Framing Bias in the Interpretation of Quality Improvement Data: Evidence From an Experiment." *International Journal of Health Policy and Management* 8 (5): 307–14.

Bartlett, J. G., Y. Iwasaki, B. Gottlieb, D. Hall, and R. Mannell. 2007. "Framework for Aboriginal-Guided Decolonizing Research Involving Métis and First Nations Persons with Diabetes." *Social Science & Medicine* 65 (11): 2371–82.

Berg, B. L. 2001. *Qualitative Research Methods for the Social Sciences*. Boston: Allyn and Bacon.

Broniatowski, D. A., A. M. Jamison, S. Qi, L. Alkulaib, T. Chen, A. Benton, S. C. Quinn, and M. Dredze. 2018. "Weaponized Health Communication: Twitter Bots and Russian Trolls Amplify the Vaccine Debate." *American Journal of Public Health* 108 (10): 1378–84.

Castleden, H., T. Garvin, and H. First Nation. 2008. "Modifying Photovoice for Community-Based Participatory Indigenous Research." *Social Science & Medicine* 66 (6): 1393–1405.

Chambers, R. 1983. *Rural Development: Putting the Last First*. London: Longman Group Ltd.

Charania, N. A., and L. J. S. Tsuji. 2012. "A Community-Based Participatory Approach and Engagement Process Creates Culturally Appropriate and Community Informed Pandemic Plans after the 2009 H1N1 Influenza Pandemic: Remote and Isolated First Nations Communities of Sub-Arctic Ontario, Canada." *BMC Public Health* 12: 268.

Charron, J., A. Gautier, and C. Jestin. 2020. "Influence of Information Sources on Vaccine Hesitancy and Practices." *Médecine et Maladies Infectieuses* 50 (8): 727–33. <https://doi.org/10.1016/j.medmal.2020.01.010>.

CIHR, NSERC, and SSHRC. 2019. "Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans." <https://ethics.gc.ca/eng/documents/tcps2-2018-en-interactive-final.pdf>.

Corbie-Smith, G. 2021. "Vaccine Hesitancy Is a Scapegoat for Structural Racism." *JAMA Health Forum* 2 (3): e210434. <https://doi.org/>

Davies, C., C. Timu-Parata, J. Stairmand, B. Robson, A. Kvalsvig, D. Lum, and V. Signal. 2022. "A Kia Ora, A Wave and A Smile: An Urban Marae-Led Response to COVID-19, A Case Study in Manaakitanga." *International Journal for Equity in Health* 21 (no.70): 2–11.

Ferrara, E., S. Cresci, and L. Luceri. 2020. "Misinformation, Manipulation, and Abuse on Social Media in the Era of COVID-19." *Journal of Computational Social Science* 3 (2): 271–77.

Flicker, S., P. O'Campo, R. Monchalin, J. Thistle, C. Worthington, R. Masching, A. Guta, S. Pooyak, W. Whitebird, and C. Thomas. 2015. "Research Done in 'A Good Way': The Importance of Indigenous Elder Involvement in HIV Community-Based Research." *American Journal of Public Health* 105 (6): 1149–54.

Griffith, J., H. Marani, and H. Monkman. 2021. "COVID-19 Vaccine Hesitancy in Canada: Content Analysis of Tweets Using the Theoretical Domains Framework." *Journal of Medical Internet Research* 23 (4): e26874.

Himelein-Wachowiak, M., S. Giorgi, A. Devoto, M. Rahman, L. Ungar, H. A. Schwartz, D. H. Epstein, L. Leggio, and B. Curtis. 2021. "Bots and Misinformation Spread on Social Media: Implications for COVID-19." *Journal of Medical Internet Research* 23 (5): e26933.

Johnson, N. F., N. Velásquez, N. J. Restrepo, R. Leahy, N. Gabriel, S. El Oud, M. Zheng, P. Manrique, S. Wuchty, and Y. Lupu. 2020. "The Online Competition between Pro- and Anti-Vaccination Views." *Nature* 582 (7811): 230–33.

Kahneman, D. 2013. *Thinking, Fast and Slow*. 1st edition. New York: Farrar, Straus and Giroux.

Larson, H. J., and D. A. Broniatowski. 2021. "Volatility of Vaccine Confidence." *Science* 371 (6536): 1289.

Larson, H. J., L. Lin, and R. Goble. 2022. "Vaccines and the Social Amplification of Risk." *Risk Analysis* 42 (7): 1409–22.

Lavallée, L. F. 2009. "Practical Application of an Indigenous Research Framework and Two Qualitative Indigenous Research Methods: Sharing Circles and Anishnaabe Symbol-Based Reflection." *International Journal of Qualitative Methods* 8 (no.1): 21–40.

MacDonald, N. E., and SAGE Working Group on Vaccine Hesitancy. 2015. "Vaccine Hesitancy: Definition, Scope and Determinants." *Vaccine* 33 (34): S0264-410X(15)00500-9: 4161–64.

Menachemi, N., B. E. Dixon, K. K. Wools-Kaloustian, C. T. Yiannoutsos, and P. K. Halverson. 2021. "How Many SARS-CoV-2-Infected People Require Hospitalization? Using Random Sample Testing to Better Inform Preparedness Efforts." *Journal of Public Health Management and Practice* 27 (3): 246–50.

Mosby, I., and J. Swidrovich. 2021. "Medical Experimentation and the Roots of COVID-19 Vaccine Hesitancy among Indigenous Peoples in Canada." *CMAJ* 193 (11): E381–83.

Muhajarine, N., D. A. Adeyinka, J. McCutcheon, K. L. Green, M. Fahlman, and N. Kallio. 2021. "COVID-19 Vaccine Hesitancy and Refusal and Associated Factors in an Adult Population in Saskatchewan, Canada: Evidence from Predictive Modelling." *PLoS One* 16 (11): e0259513.

Newman, P. A., M. R. Woodford, and C. Logie. 2012. "HIV Vaccine Acceptability and Culturally Appropriate Dissemination among Sexually Diverse Aboriginal Peoples in Canada." *Global Public Health* 7 (1): 87–100.

Nobel Prize. 2002. "'The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2002.' NobelPrize.Org." <https://www.nobelprize.org/prizes/economic-sciences/2002/popular-information/>.

Odum, F. 2021. "COVID Conspiracy Narratives: Dissecting the Origins of Misinformation in Digital Space." Geography Honors Projects. https://digitalcommons.maclester.edu/geography_honors/68.

Opel, D. J., B. Lo, and M. E. Peek. 2021. "Addressing Mistrust About COVID-19 Vaccines Among Patients of Color." *Annals of Internal Medicine* 174 (5): M21-0055: 698–700.

Panchal, R., and A. Jack. 2022. "The Contagiousness of Memes: Containing the Spread of COVID-19 Conspiracy Theories in a Forensic Psychiatric Hospital." *BJPsych Bulletin* 46 (1): 36–42.

- Perry, C., K. Chhatralia, D. Damesick, S. Hobden, L. Volpe, and Health Foundation (Great Britain). 2015. *Behavioural Insights in Health Care: Nudging to Reduce Inefficiency and Waste*, 18–29. London: The Health Foundation.
- Power, T., D. Wilson, O. Best, T. Brockie, L. Bourque Bearskin, E. Millender, and J. Lowe. 2020. "COVID-19 and Indigenous Peoples: An Imperative for Action." *Journal of Clinical Nursing* 29 (15–16): 2737–41.
- Priebe, J., H. Silber, C. Beuthner, and S. Pötschke. 2022. "How (Not) to Mobilize Health Workers in the Fight against Vaccine Hesitancy: Experimental Evidence from Germany's AstraZeneca Controversy." *BMC Public Health* 22 (1): 2–24.
- Public Health Agency of Canada. 2021. "COVID-19 Vaccine Safety: Weekly Report on Side Effects Following Immunization." Datasets; Statistics; Education and Awareness. Aem. 2021. September 24, 2021." <https://health-infobase.canada.ca/covid-19/vaccine-safety/>.
- Reading, C., and F. Wien. 2009. "Health Inequalities and Social Determinants of Aboriginal Peoples' Health." National Collaborating Centre for Aboriginal Health, 36." Accessed July 26, 2022. <https://www.ccsa-nccah.ca/docs/determinants/RPT-HealthInequalities-Reading-Wien-EN.pdf>.
- Restoule, J.-P. 2004. "(Jean-Paul François). 'Male Aboriginal Identity Formation in Urban Areas: A Focus on Process and Context.' Ph.D Diss. University of Toronto."
- Schoch-Spana, M., E. K. Brunson, R. Long, A. Ruth, S. J. Ravi, M. Trotochaud, L. Borio, et al. 2021. "The Public's Role in COVID-19 Vaccination: Human-Centered Recommendations to Enhance Pandemic Vaccine Awareness, Access, and Acceptance in the United States." *Vaccine* 39 (40): S0264-410X(20)31368-2: 6004–12.
- Starblanket, D., S. Lefebvre, M. Legare, J. Billan, N. Akan, E. Goodpipe, and C. Bourassa. 2019. "Nanâtawihowin Ācimowina Kika-Mōsahkinikēhk Papiskīci-Itascikēwin Astācikowina [Medicine/Healing Stories Picked, Sorted, Stored]: Adapting the Collective Consensual Data Analytic Procedure (CCDAP) as an Indigenous Research Method." *International Journal of Qualitative Methods* 18.
- United Nations. 2007. "United Nations Declaration on the Rights of Indigenous Peoples." Geneva." https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf.
- Usher, N. 2020. "News Cartography and Epistemic Authority in the Era of Big Data: Journalists as Map-Makers, Map-Users, and Map-Subjects." *New Media & Society* 22 (2): 247–63.
- Verd, S., M. Fernández-Bernabeu, and E. Cardo. 2022. "The Controversy Surrounding Vaccination of Young People against COVID-19." *Acta Paediatrica (Oslo, Norway)* 111 (1): 187–88.
- World Health Organization. 2020. "Behavioural Considerations for Acceptance and Uptake of COVID-19 Vaccines: WHO Technical Advisory Group on Behavioural Insights and Sciences for Health, Meeting Report." Geneva: World Health Organization. <https://apps.who.int/iris/handle/10665/337335>.