KNOW IT OR NOT: EXAMINING GAMIFIED INTERVENTIONS IN A REAL-WORLD PUBLIC HEALTH EDUCATION CAMPAIGN, AND CO-CREATING CUSTOMIZED TOOLS FOR EQUITY-DESERVING COMMUNITIES

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INTRODUCTION

The emergence of the COVID-19 virus during the age of rapid social connectivity produced an unprecedented symbiosis between a physically detrimental disease and socially harmful misinformation. Three years later, the world continues to contend with the intrinsic virality and constant evolution of these intertwined maladies that threaten the health and future of our communities.

An overabundance of information sharing during a pandemic is expected since public health issues are emotionally charged and value laden (Trevors & Ladhani, 2022), especially as we witness the harrowing consequences of an outbreak amidst persisting social inequities. Being bombarded with constantly changing and often conflicting news about an infectious disease, whilst trying to cope with the upending of "normal" life is anxiety-provoking (Abadi et al., 2021; Neill et al., 2021). This anxiety drives greater information-seeking in an effort to reduce the aversive feeling of uncertainty (Jungmann & Witthoft, 2020). However, when intense emotions are coupled with the speed, multiple mechanisms and lack of individual accountability with which information has been transmitted during the COVID-19 pandemic, we must reconsider our approach to health promotion and public education.

COUNTERING MISINFORMATION WITH GAMIFIED DIGITAL TOOLS

Technology has undeniably been the conduit for the alarming rise in misinformation globally, but it can also be a powerful tool to address it due to the same reasons: unparalleled reach, attention captivity and behavioural influence. Gamification is a form of technology that represents a new approach to education because it can offer personalized and positive interactions between individuals and information. By dynamically adapting to individuals' behaviors and responses as they play,

a gamified educational tool can enrich engagement and inform decision-making overall (Baram-Tsabari & Schejter, 2019).

Digital Public Square investigated the causal effects of gamified refutations regarding COVID-19 vaccine misconceptions on key outcomes within a large randomized control trial (RCT). Refutations have a substantial body of evidence supporting their use to correct misconceptions, yet reduced efficacy has been observed for some topics that generate negative emotional responses (Sharot & Sunstein, 2020; Trevors & Ladhani, 2022). A nationally representative sample of 4071 Canadian adults were recruited for a RCT between December 8th to 30th, 2022. They were randomly assigned to one of three conditions: gamified intervention (the *Know it or Not* game), active control blog (a non-gamified information page containing the same information as the game), or a no-information control condition. We contrasted these three conditions on their end-of-study vaccine knowledge/misinformation retention, vaccine confidence, and intent to receive a vaccine in the next six months. Participants' responses to knowledge questions were given a score of 1 if they answered correctly, 0 if they said they were "unsure", and -1 if answered incorrectly. Contrasts were performed for the full sample and among individuals who have not yet received a COVID-19 booster (i.e., two doses or fewer; N = 1503 or 37% of the full sample), for whom we hypothesized the intervention would have the most impact. Means for each condition and subsample are reported in Table 1.

TABLE 1: DESCRIPTIVE STATISTICS FOR OUTCOME VARIABLES ACROSS EXPERIMENTAL CONDITIONS

	Game		Blog		Control	
	Full	Unboosted	Full	Unboosted	Full	Unboosted
Knowledge[a]	**65%**	**50%**	58%	40%	24%	-2%
Confidence	**72%**	**53%**	70%	48%	65%	45%
Intent to receive	75%	**54%**	73%	49%	66%	43%

Note: Bolded values denote the unique statistically highest mean, $p < .05$.
[a]Range of possible values -100% to 100% to reflect presence of misconceptions vs. accurate knowledge, respectively.

Compared to the blog, and based on preliminary analysis, the identical content presented in the gamified context resulted in more vaccine knowledge (25% improvement among unboosted), confidence in vaccines (10% improvement among unboosted), and intent to get vaccinated in the next 6 months (8% improvement among unboosted).

UNDERSTANDING THE NEEDS AND PRIORITIES OF DIVERSE COMMUNITIES

We have seen a high level of engagement with the *Know it or Not* tool overall, with over 140,000 gameplays equating to over 1.3 million questions answered since November 2021. As a privacy first platform, the gamified tool does not collect personally identifiable data but users can opt-in to share demographic information. Based on those that choose to self-identify, the tool has lower engagement with certain communities disproportionately affected by COVID-19, particularly Black and Indigenous peoples. Thus, reaching these communities remains a key challenge and priority.

Given the complexity of vaccine hesitancy and the diversity within equity-deserving groups, we undertook in-depth qualitative engagement with members of Indigenous and Black communities across the age, gender, sexuality and socio-economic spectrum, to understand their pandemic experiences. We conducted three focus groups with Black community members in July and December 2022 (n = 27), and undertook in-depth interviews with 5 Indigenous health care professionals and community leaders in November 2022. The findings of this research are informing the development of customized versions of our gamified platform that are intended to meet the health information needs of Black and Indigenous communities, respectively.

Unsurprisingly, participants across both groups indicated the greatest driver of their community's vaccine hesitancy stemmed from systemic racism and distrust in the government. They emphasized that a critical first step in conversations about COVID-19 vaccine hesitancy is acknowledging that their skepticism of healthcare systems and public health initiatives is rooted in their historical and ongoing mistreatment in health-care environments.

FINDINGS FROM OUR ENGAGEMENT WITH INDIGENOUS COMMUNITY LEADERS

Indigenous identifying interviewees shared that the COVID-19 vaccine also presented challenges to their cultural identity, something they have had to strongly advocate for since colonization. For example, COVID-19 promotion is reminiscent of forced assimilation for some and the requirements for a status card to access healthcare means that Indigenous identities are questioned or need qualification by the government. Respecting the environment is also shared as critical in the Indigenous culture and western medicine is sometimes viewed as an interference with natural processes. Communications about the vaccine as a tool for returning to "normalcy" are perceived by some as a desire to return to practices that were harmful to our planet and their communities. Thus, core Indigenous beliefs can often be at odds with paternalistic messaging from authorities about their directives and inventions, such as the vaccine, being appropriate and necessary.

FINDINGS FROM OUR ENGAGEMENT WITH BLACK COMMUNITY MEMBERS

Black community members expressed the need for more visibility and acknowledgement of Black peoples' efforts in the pandemic response, including Black scientists' involvement in developing the vaccine. Appropriately recognizing and celebrating the role of Black people in healthcare helps build confidence and promotes a more inclusive healthcare system. Another key concern was the need for transparency regarding how personal information and data will be used.

WHAT DOES EFFECTIVE HEALTH COMMUNICATION LOOK LIKE TO INDIGENOUS COMMUNITIES?

Our consultations with Indigenous health practitioners emphasized that effective health communication in the Indigenous community requires information sharing by trusted cultural sources, data transparency, understanding the gravity of making a choice and fostering open dialogue.

Connecting health information sources to the Indigenous culture is critical and can be fairly straightforward to implement (for example, an Indigenous health practitioner explaining how vaccines are made from natural ingredients). Jointly, health promotion efforts need to consider past trauma and acknowledge the drivers of mistrust in order to gradually earn trust. This includes clarifying the purpose of data collection, data ownership and the rights of individuals to access or inquire about that information.

Furthermore, a one-size-fits-all model for addressing vaccine hesitancy within the Indigenous community is inadequate, and the level of social pressure that individuals may face when deciding about vaccination is often underestimated and minimized. Therefore, reflecting diverse viewpoints and acknowledging the emotional underpinnings of these decisions is crucial. Moreover, storytelling was asserted as the most culturally relevant approach to the traditional Indigenous knowledge system, and holds the potential to create a culturally safe environment by using communications material that shows genuine curiosity about traditional healing and allows open knowledge exchange.

WHAT DOES EFFECTIVE HEALTH COMMUNICATION LOOK LIKE TO BLACK COMMUNITIES?

Our community engagement found three key recommendations for effective health promotion in Black communities: an acknowledgement of systemic racism, Black representation in communications materials, and promoting the broader protection of the Black community through vaccination.

Black community members indicated that highlighting systemic racism in healthcare settings as a key driver of distrust in the COVID-19 vaccine is required to create a space where they feel comfortable to express concerns and seek advice about health. Respondents also asserted the importance of representation in generating meaningful connection. Including images of Black clients, doctors, and other healthcare professionals in communication materials acknowledges the valuable contributions of Black people in the vaccine development process, and may therefore aid in easing distrust. Additionally, framing vaccination as a way of protecting the broader Black community is helpful, though care is required to ensure that vaccine hesitancy is not framed as a form of community harm or betrayal. Creating a compassionate conversation about taking care of others whilst respecting bodily autonomy is key.

DIGITAL HEALTH TOOLS BUILT BY THE COMMUNITY, FOR THE COMMUNITY

Putting these learnings into practice promotes the development of online education platforms that are co-created with the communities they are meant to serve. These in-depth research findings have informed the product design (the look and feel), content (information), and distribution (how it's

being shared) of custom tools for each respective community. The inclusive product development process involved our Indigenous and Black-led project partners evaluating the content and design of our *Know it or Not* tool and seeking feedback from their respective community networks to propose modifications, while still maintaining the benefits of a gamified approach.

The customized tool for Indigenous communities adopts a storytelling approach to discuss health issues and concerns, using visual representation of the culture through the depiction of Indigenous people and elements of nature. Information in the tool will be narrated from the point of view of different members of the Indigenous community so that diverse views are represented and explored, focusing on Indigenous medicine and acknowledging the pressure involved in choosing to be vaccinated. The Indigenous health professionals engaged during our research process and our Indigenous collaboration partners will share the tool with their networks, serving as trusted distribution channels in the community.

The customized tool for Black communities presents topics in an exploratory modular format so that users can choose what they want to learn. The content centres Black experiences, specifically by acknowledging reasons why Black communities may distrust vaccines, and includes open-text questions where users can simply express how they feel. Trust in the tool will be built by distributing through Black-led organizations/networks, who stand to mutually benefit from the data insights collected when using them to inform their own health promotion activities.

Thus, the experience of validating a gamified approach to address health misinformation, coupled with Black and Indigenous community-led collaborations on the development and dissemination of customized tools, paves the way for greater and more equitable impact on improving vaccine confidence among equity-deserving communities. Our customized products serve the double purpose of both health promotion and data insights tools. For Indigenous and Black audiences, they deliver important, culturally sensitive information about the COVID-19 vaccines. For organizations or people that choose to disseminate the tools through their communications channels, they collect aggregate data insights about the health concerns of their audiences, which can then inform health promotion strategies at different scales, without compromising privacy. While the empirical insights from these custom tools will be available in March 2023, the findings from this work can inform public health interventions seeking to reach equity-deserving communities in Canada for many years to come.

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