





BMJ Open Evaluating the impact of a linguistically and culturally tailored social media ad campaign on COVID-19 vaccine uptake among indigenous populations in Guatemala: a pre/post design intervention study

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ABSTRACT

Objectives To evaluate the impact of culturally and linguistically tailored informational videos delivered via social media campaigns on COVID-19 vaccine uptake in Indigenous Maya communities in Guatemala.

Methods Our team designed a series of videos utilising community input and evaluated the impact using a pre-post intervention design. In-person preintervention surveys were collected from a sample of respondents in four rural municipalities in Guatemala in March 2022. Facebook, Instagram and browser ads were flooded with COVID-19 vaccine informational videos in Spanish, Kaqchikel and Kiche for 3 weeks. Postintervention surveys were conducted by telephone among the same participants in April 2022. Logistic regression models were used to estimate the OR of COVID-19 vaccine uptake following exposure to the intervention videos.

Results Preintervention and postintervention surveys were collected from 1572 participants. The median age was 28 years; 63% (N=998) identified as women, and 36% spoke an Indigenous Mayan language. Twenty-one per cent of participants (N=327) reported watching the intervention content on social media. At baseline, 89% (N=1402) of participants reported having at least one COVID-19 vaccine, compared with 97% (N=1507) in the follow-up. Those who reported watching the videos had 1.78 times the odds (95% CI 1.14 to 2.77) of getting vaccinated after watching the videos compared with those who did not see the videos when adjusted by age, community, sex and language.

Conclusion Our findings suggest that culturally and linguistically tailored videos addressing COVID-19 vaccine misinformation deployed over social media can increase vaccinations in a rural, indigenous population in Guatemala, implying that social media content can influence vaccination uptake. Providing accurate, culturally sensitive information in local languages from trusted sources may help increase vaccine uptake in historically marginalised populations.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The study was done using a pre-post intervention survey among the same individuals to measure COVID-19 vaccine uptake following the social media intervention at the community level.
- ⇒ The recruitment strategy allowed us to evaluate the intervention in hard-to-reach indigenous groups who might be overlooked or hard to classify using social media data.
- ⇒ Participants were recruited using convenience sampling (not randomised) in four rural communities in the central highlands of Guatemala.
- ⇒ The primary outcome (COVID-19 vaccine uptake) and exposure to the intervention were self-reported.

BACKGROUND

Over the course of the COVID-19 pandemic, Latin America has recorded some of the highest COVID-19 mortality rates in the world.¹ The region has had notable challenges in responding to COVID-19, including under-resourced healthcare systems, barriers to healthcare access driven by social inequities and a lack of hospital beds and skilled healthcare workers to care for patients.^{2 3} These challenges have contributed to significant morbidity and mortality, compounded by low vaccination rates across many countries in the region.^{4 5} Within the region, Guatemala has a widely variable regional vaccine distribution resulting in one of the lowest COVID-19 vaccination rates across Latin America; only 38% of the whole population has completed the initial two-dose series of the COVID-19 vaccination protocol (as of July 2022).⁶

There are stark disparities in vaccination rates between communities in Guatemala. Most COVID-19 vaccines have been administered in urban settings, leaving many rural indigenous communities without access.⁷ Indigenous people represent more than 40% of the country's population, but the municipalities where most of them live are the least vaccinated. For example, 70% of people in Guatemala City have been fully vaccinated, compared with 35% of people in the department of Sololá, where almost all residents are Kaqchikel Mayan.⁸ However, even within departments where most of the population is indigenous, those living in more urbanised municipalities have higher vaccination rates than those living in rural municipalities.⁹

The indigenous population of Guatemala has historically experienced systemic violence and health inequities which increases their risk of adverse health outcomes, including communicable diseases such as COVID-19.^{4 10} The lack of well-funded public health infrastructure in the country disproportionately affects Indigenous populations, who are mainly rural and have to travel far to find care. When they can access healthcare, they face mistreatment, discrimination, and cultural and linguistic barriers.¹¹ All these factors have exacerbated the impact of the COVID-19 pandemic in this population, putting them at an increased risk of disease. At the same time, they face additional challenges in accessing treatment and vaccines.¹²

Multiple system-level barriers to COVID-19 vaccination exist, including unequal distribution between municipalities, the lack of existing health infrastructure and clinics in these communities, and almost no culturally sensitive and linguistically appropriate communication campaigns.^{13 14} At the individual level, research has identified several barriers to vaccination, including fear of side effects, vaccine misinformation, lack of information and certain religious beliefs.^{15–17} All these factors are exacerbated by the historical mistrust towards the government by these communities after years of human rights atrocities and the marginalisation of the indigenous communities resulting in structural racism.¹⁸

Evidence shows that distrust of government is a predictor of misinformation. In Guatemala, this was exacerbated by a lack of information in multiple indigenous languages.¹⁹ The government prioritised information and materials in Spanish; however, Guatemala has more than 25 languages and official translation to them began 8 months after the vaccine campaign launched. A lack of information created a void that was quickly filled with misinformation, which was amplified through social media.^{7 13} Previous research has shown that marginalised communities are more likely to be exposed to and believe false information which social media have fuelled during the COVID-19 pandemic.^{20 21}

In recent years, there has been increased interest in the ability of social media interventions (eg, videos spread on Facebook) to address public health issues, and this area of work was heightened in the COVID-19 pandemic.²² Many

social media interventions were developed to combat misinformation and to provide more accurate information about COVID-19 and vaccinations. However, there are challenges to measuring the impact of such interventions on actual behaviours and knowledge, and thus, many such interventions have relied on online surveys to capture data about intentions and perceptions among those exposed.²³ Understanding if social media interventions impact behaviour, such as COVID-19 vaccine uptake, is needed.

To address the information gap and counter misinformation, our team used a community-engaged research approach to design a culturally tailored COVID-19 vaccine campaign in Spanish, K'iche and Kaqchikel languages, and deliver it through social media. The main aim of this study was to evaluate the impact on vaccine uptake of the social media campaign in Patzún, San Andrés Semetabaj, Solalá and Tecpán, mainly Indigenous rural municipalities in the Guatemala Central Highlands.

METHODS

Study design and setting

The study used a pre–post intervention design to evaluate the effectiveness of a social media campaign on vaccine access in four, mainly indigenous, rural communities in Guatemala. Participants were recruited and preintervention surveys were conducted during the first 2 weeks of March 2022 in Patzún, San Andrés Semetabaj, Solalá and Tecpán, all municipalities of the Guatemala Central Highlands. These are communities where our in-country partner community partner, Wuqu' Kawoq | Maya Health Alliance, holds regular activities. Postintervention surveys were collected in the same participants via phone following the intervention in April 2022.

Patient and public involvement

A community-engaged research framework was used throughout our project, including project design, formative work, intervention design, evaluation and dissemination.¹⁶ Wuqu' Kawoq is deeply entrenched in local indigenous communities, providing culturally sensitive healthcare and health education to these communities in Guatemala for over 15 years. Their current activities included COVID-19 prevention, and one of their current priorities is COVID-19 vaccine communications to local communities in Mayan languages. Our intervention was additive to their priorities and efforts. All the fieldwork (survey collection) was done by community health workers from the local communities. Our intervention was developed in partnership and based on formative work with community members, who also provided the script translation and voice-over for the videos, which were disseminated through their channels. Multiple dissemination strategies were used to ensure local stakeholders were aware of the findings, using the community and community partners as the primary messengers.

Participants and data collection

People over 18 years of age who lived in the included communities and provided a phone number to complete the follow-up interview were eligible to participate. Trained multilingual community members were deployed to the communities for 2 weeks and selected participants through convenience sampling among people at the town centre or around the health clinic. Following informed consent, participants were asked questions that the interviewer filled on a phone or a tablet using Qualtrics. Questions included their demographic characteristics, COVID-19 vaccine status, vaccine confidence and hesitancy, vaccine access, vaccine information sources and social media use. Participants who provided a working phone number to our study team and consented to be contacted again were followed up with for the postintervention survey via telephone 3 weeks later at completion of the intervention. Participants were called three times within 2 days after which they were considered lost to follow-up. Surveys consisted of 25 closed-ended questions and lasted on average 12 min. Interviews were conducted in Spanish, K'iche or Kaqchikel using a translated survey tool. Preintervention and postintervention surveys were matched using unique ID numbers randomly generated by Qualtrics. Based on sample size calculations, our study needed 500 participants to estimate the effect of the intervention on vaccine uptake.

Intervention

The intervention was designed in collaboration with the Stanford Center for Health Education's Digital Medic initiative using a qualitative human-centred design approach through in-person, in-depth key informant interviews and community focus groups to understand better vaccination barriers, including access, supply, trust and fear.²⁴ The interviews identified the main COVID-19 vaccines myths and sought to understand information sharing using social media networks in that region of Guatemala. Findings from the qualitative phase informed the development of the social media campaign, including two animated video series with three one-to-two min video clips each. The first video series focuses on the COVID-19 vaccine basic information, including how vaccines work and the side effects. The second series addresses the central myths and misinformation identified in the community, which are beliefs that the vaccine can kill, there is a microchip in the vaccine and the vaccine causes infertility. All videos are identical with translations and captions in Spanish, K'iche and Kaqchikel. Narration is provided by local voice talent. Videos are open source and continue to be available on YouTube (https://www.youtube.com/playlist?list=PLuhZ6_ONjgIlb0UgAGiWR0_ZfsIX3hpt7).

The videos were deployed on users' Facebook, and Instagram Feeds from the Wuqu' Kawoq Facebook page and promoted through the Facebook Advertisement Platform. Users were selected via Facebook's advertising algorithm to receive the campaign videos one or two times per week on Facebook, Instagram and browser ads where

Facebook ads were enabled. Campaign videos were available for 3 weeks, from 14 March 2022 to 4 April 2022.

Measurement

Our primary outcome was COVID-19 vaccine uptake, which was assessed by comparing self-reported vaccination status in the preintervention and postintervention surveys. Participants were considered vaccinated regardless of the number of doses they had received and unvaccinated if they had never received any doses. Possible answers were 'yes,' 'no' and 'don't know'; only four respondents answered 'don't know' and were therefore eliminated from the analysis.

The main predictor of our study was exposure to the intervention. To assess exposure, participants received a screenshot of the videos via WhatsApp and were asked if they had seen them before. Answers were 'yes,' 'no' and 'don't remember.' Participants who could not receive the images (eg, did not have WhatsApp enabled on their phones) were given an oral description of the videos and asked if they had seen the video; answers were yes, no and don't remember. For the analysis, only people who said yes or no to either the screenshots or oral descriptions were included; people who could not remember were counted as unexposed.

Covariates included age, sex, community, language spoken at home and past COVID-19 infection. Age was operationalised as a continuous variable, and sex, had 'male,' 'female' or 'other' (only one participant identified as other). Communities in which the interview took place included 'Patzún,' 'San Andrés Semetabaj,' 'Solalá' or 'Tecpán.' Language spoken at home included 'K'iche,' 'Kaqchikel,' 'Spanish' or 'other.' Lastly, they were asked to self-report a past COVID-19 infection, including yes, no or don't know.

Additionally, the survey collected information on the participant's social media use and their primary COVID-19 information sources. Social media questions included access to and preferences for social media platforms, exposure to COVID-19 information and sharing behaviour.

Statistical analysis

All analyses were conducted using StataIC V.16.0.809. Differences in baseline characteristics between vaccinated and unvaccinated participants were presented using percentages for categorical variables, medians and IQRs for continuous variables. Differences between groups were assessed using proportion and Kruskal-Wallis tests. We used logistic regression to estimate ORs and 95% CIs to evaluate COVID-19 vaccine uptake in an unadjusted model, an adjusted model among the whole sample, and an adjusted model among those unvaccinated at baseline. The analysis's main predictor was intervention exposure, and our primary outcome was COVID-19 vaccine uptake. Models were adjusted for possible confounders, including age, sex, community and home language.

Table 1 Characteristics of participants surveyed in Guatemala COVID-19 vaccine social media campaign, by vaccination status at baseline

Characteristic	Total (n=1572) N (%)	Vaccinated at baseline (n=1402) N (%)	Unvaccinated at baseline (n=170) N (%)
Age, years ^{**} , [§]	28 (22–39)	28 (22–40)	24 (20–34)
Female sex	998 (63)	894 (64)	104 (61)
Community			
Patzún ^{**}	290 (18)	274 (19)	16 (9)
San Andrés Semetabaj	571 (36)	503 (36)	64 (37)
Sololá ^{***}	163 (10)	123 (9)	40 (23)
Tecpán	552 (35)	502 (36)	50 (29)
Language spoken at home			
Kiche	135 (9)	114 (8)	21 (12)
Kaqchikel ^{***}	435 (28)	367 (26)	68 (40)
Spanish ^{***}	993 (63)	910 (65)	83 (47)
Other	9 (0.5)	9 (0.6)	0
Vaccinated against COVID-19 with at least one dose ^{&}	1402 (89)	1402 (100)	0
Previous COVID-19 infection ^{*, &}			
Yes	169 (11)	159 (11)	10 (6)
No	1365 (87)	1208 (86)	157 (92)
Not sure	38 (2)	35 (3)	3 (2)

*p<0.05, **p<0.01, ***p<0.001.
[§]Median and interquartile range.
[&] Self-reported.

RESULTS

Baseline characteristics are presented in [table 1](#). We completed and successfully matched 1572 preintervention and postintervention surveys. The median age of participants was 28 years (IQR 22–39), 63% (N=998) and identified as female, and 37% spoke an indigenous language at home (28% spoke Kaqchikel and 9% Kiche). Eighty-nine per cent of the sample reported having at least one COVID-19 vaccine at baseline. Vaccinated individuals were significantly older and more likely to have had COVID-19 previously. There were also differences in vaccination status by region, with lower vaccination rates in Sololá and higher rates in Patzún. There were also significant differences in vaccination rates by primary language, with Spanish-speaking participants having higher rates and Kaqchikel-speaking participants having lower rates.

Twenty-one per cent of the participants (N=327) reported having watched the intervention content; there was no difference in exposure between participants vaccinated or unvaccinated at baseline. Among those who saw the videos, 98% reported learning something new about the vaccines. At baseline, 89% (N=1402) of participants said having been vaccinated against COVID-19 with at least one dose compared with 97% (N=1507) in the follow-up. Among the whole sample (adjusted model 1, [table 2](#)), those who reported watching the videos had 1.78 times the odds (95% CI 1.14 to 2.77) of getting their first

COVID-19 vaccine compared with those who reported not watching it, adjusted by age, community, sex and language spoken at home. When stratified by vaccination status at baseline (adjusted model 2, [table 2](#)), among those vaccinated, those who reported watching the videos had 3.92 times the odds (95% CI 1.56 to 9.8) of getting their first COVID-19 vaccine compared with those who reported not watching it, adjusted by age, community, sex and language spoken at home.

Despite the high vaccination rate in our sample, about one-fourth of those who were unvaccinated had tried to become vaccinated but faced access barriers such as vaccine or personnel shortages. The most common reasons unvaccinated people gave for not wanting a COVID-19 vaccine were fear of side effects (30%), fear of dying from the vaccine (19%) and lack of information about the vaccines (10%). Another misperception participants noted was the idea that having a comorbidity, such as diabetes or being pregnant, meant they were not eligible for vaccination or that vaccination was not safe for them.

Additionally, as shown in [table 3](#), social media was the most common place people accessed vaccine information, with 46% of participants using social media for this purpose. Among those using social media, 76% of respondents said that Facebook was the platform they used the most. Ninety-seven per cent noted that the information they have seen about COVID-19 vaccines was in Spanish,

Table 2 Unadjusted and adjusted logistic regression evaluating COVID-19 vaccine uptake following COVID-19 vaccine social media campaign

Characteristic	Unadjusted		Adjusted model 1		Adjusted model two among those unvaccinated at baseline	
	OR (95% CI)	P value	OR* (95% CI)	P value	OR* (95% CI)	P value
Exposed to vaccine campaign	1.86 (1.20 to 2.86)	0.005	1.78 (1.14 to 2.77)	0.01	3.91 (1.56 to 9.8)	0.04
Age	0.97 (0.96 to 0.99)	0.02	0.97 (0.95 to 0.99)	0.004	1 (0.98 to 1.03)	0.51
Sex						
Men	Ref.		Ref.		Ref.	
Women	0.99 (0.65 to 1.50)	0.98	0.96 (0.62 to 1.47)	0.87	1.22 (0.60 to 2.48)	0.57
Community						
San Andrés (SA)	Ref.		Ref.		Ref.	
Patzún (PA)	0.24 (0.10 to 0.57)	0.001	0.27 (0.11 to 0.67)	0.85	0.33 (0.09 to 1.15)	0.08
Solalá (SO)	1.59 (0.91 to 2.78)	0.10	1.66 (0.91 to 3.03)	0.09	0.75 (0.29 to 1.91)	0.54
Tecpán (TE)	0.70 (0.44 to 1.12)	0.13	0.75 (0.46 to 1.24)	0.26	1.07 (0.45 to 2.56)	0.86
Home language						
Spanish	Ref.		Ref.		Ref.	
Kaqchikel	1.42 (0.91 to 2.23)	0.12	1.63 (0.99 to 2.67)	0.05	0.55 (0.25 to 1.22)	0.14
Kiche	2.33 (1.29 to 4.21)	0.005	2.07 (1.12 to 3.83)	0.02	1.52 (0.47 to 4.85)	0.47

*All variables adjusted for all other variables in column.

despite the high percentage of participants who spoke an indigenous language.

DISCUSSION

It is estimated that COVID-19 vaccines saved between 14.4million and 20million lives globally during the first year of their roll-out.²⁵ Despite this success, global, regional and national inequities prevent vulnerable populations, such as indigenous communities, from accessing

the vaccine. Complimentary to addressing supply and access challenges, there is a need to improve demand in these communities. Our research shows that providing targeted, culturally and linguistically appropriate information campaigns via social media may increase vaccine uptake in mostly indigenous communities in Guatemala. The survey-based evaluation of our intervention showed that participants who reported watching a culturally informed and aware video about COVID-19 vaccines were more likely to become vaccinated against COVID-19 compared with those who had not watched the video. The observed impact was more significant when only unvaccinated participants at baseline in the analysis were included.

Like other studies, our findings show that social media offers a unique opportunity to improve health communications targeted at hard-to-reach populations.^{26–29} In addition to providing educational information, these campaigns help counter the increasing amount of misinformation on these platforms. Our study adds to the limited existing evidence on real world impacts of social media campaigns on behaviours such as vaccine uptake. Although indigenous people are often considered ‘hard to reach’, 86% of our predominantly indigenous participants reported using a social media platform. Our study also found that social media was participants’ most common source of information about COVID-19 vaccines. Participants reported receiving more information on social media than from doctors and healthcare workers. All too often social media or mHealth interventions are assumed not to be appropriate for non-urban, poor or non-educated populations—but this is clearly not the

Table 3 COVID-19 information sources and social media usage among survey participants (N=1572) in Guatemala, 2022

COVID-19 information sources	
Social media	46%
Friends and family	41%
Doctors or other healthcare workers	41%
Television or radio	28%
Government	7%
Religious leaders	3%
Social media use	
Have any social media networks	86%
Have ever shared COVID-19 information through social media	16%
Have seen COVID-19 vaccine information on social media (N=1576)	72%
On Facebook (N=729)	88%
Information was only in Spanish	97%



case and this assumption could lead to vast missed opportunities. Understanding social media use and how populations access information locally and nationally is critical for governments, policy makers and healthcare systems to optimise vaccine education and encourage vaccine uptake or any other health condition or behaviour. Additionally, ensuring people can access information in a language they understand, alongside visual depictions of their culture reflected in videos or graphics, may significantly impact their trust.

This project was done using a community-engaged approach, which we believe should be the standard for any public health research, especially in marginalised communities.³⁰ Our partnership with Wuqu' Kawoq enabled us to find sustainable solutions for a priority of the organisation and community. Community partners are critical to guiding research activities and creating trust, but unfortunately, many community organisations do not have the resources or the infrastructure to lead and implement research activities. A well-balanced partnership that is open and honest about power differentials, money, and time has the potential to create and sustain impact. By involving the community in every step of the research process, we could tailor the intervention to them and gain the participants' trust.

This study has many strengths. Most existing evaluations of social media campaigns rely only on data collected over social media and cannot ascertain the impact on the ground. Our study team measured the effect of a social media campaign on individual vaccine uptake via data collected at a community level. Additionally, our large, diverse sample of rural, indigenous participants allows us to make solid statistical claims. However, this study also has limitations. The main limitation is that our sample was biased, in that it may not represent everyone living in these communities, and there may be differences between those who were recruited and agreed to participate and the broader community. This is evidenced by the fact that our sample was more highly vaccinated than the national average. We hypothesise that this may be because many participants were recruited from around healthcare facilities and towns where our community partners have regular activities and not rural villages. While not representative of all of Guatemala or even of all indigenous populations in these communities, our sample was appropriate given the nature of our intervention. Since this was a social media intervention, exposure to the intervention required having access to smart phones, Facebook and the internet. Thus, our target population was primarily urban and more well-off individuals who would be more likely to have access to this technology and thus be exposed to the intervention. The populations of the municipalities we worked in have higher vaccination rates than the national average, in Tecpán, San Andrés and Patzún, 65% of the population has received a COVID-19 vaccine while 40% of people in Solalá have.⁹ However, the increase in vaccine uptake among a highly vaccinated population provides more evidence of the potential impact of the intervention.

Other limitations include that the exposure (seeing the videos) and outcome (vaccination status) were self-reported and, therefore, could be prone to recall bias or other forms of bias. We could not randomise individuals or communities for the intervention; consequently, we had to rely on pre/post surveys and a convenience sample of individuals to participate. It is possible that individuals who were not vaccinated were less likely to participate; however, in our recruitment script we did not identify the main focus of the study as being on COVID-19 or COVID-19 vaccination, and thus think it unlikely that potential participants knew that this was the focus before agreeing to participate. Collecting two rounds of data from the same people make it possible to control for some of the bias in terms of the impact of our study, however, it does not address broader issues of generalisability.

Additional research is needed to understand the impact on other Mayan groups and languages not included in this project, who the most trusted groups or messengers are, and a comparison of communication campaigns using alternative channels to reach older populations or those who might not have a mobile device. More research is also needed about if this intervention approach (social media) is appropriate for more rural populations who may have less regular and easy access to the internet and smart phones.

CONCLUSION

Our findings showed that a culturally and linguistically concordant, community-informed campaign using social media could be used to increase vaccine confidence and address misinformation, even among a relatively highly vaccinated subgroup. Our intervention was associated with increased vaccination rates in a predominantly indigenous, urban population in Guatemala. This demonstrates that social media can be a channel to influence health behaviours. Providing information in local languages may be essential for vaccine uptake in hard-to-reach, historically marginalised populations. Additionally, our findings provide key stakeholders, including Guatemalan public health and government officials, with data on vaccine attitudes and information sources that could be leveraged to increase COVID-19 vaccine uptake in other regions of the country and perhaps regionally in Central America as well.

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Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by Stanford University Protocol # 63193UCSF IRB # 21-35735Wuqu' Kawoq IRB # WK 2021 005. Participants gave informed consent to participate in the study before taking part.

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