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COVID-19 Education and Resource Development for Punjabi-Speaking Sikh Farmworkers in California

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ABSTRACT

Objective: While the vast majority of farmworkers in California are Latinx, a small proportion of the farmworkers are Asian Indian who primarily speak Punjabi. To date, there are few COVID-19 resources developed that specifically target Punjabi-speaking farmworkers. This study examines the COVID-19 educational needs of Punjabi-speaking farmworkers in California and aims to inform future development of educational materials for Punjabi-speaking farmworkers.

Methods: During early 2021, a two-phase qualitative study was conducted. In Phase 1, five key informant interviews were conducted using a semi-structured interview guide to assess the content, visual, and cultural relevance of current COVID-19 educational resources. Based on informant feedback, new agriculture-specific COVID-19 educational resources were developed in Punjabi. In Phase 2, three focus groups were conducted (in Fresno and Yuba Counties) with five participants in each group to evaluate the newly developed COVID-19 resources.

Results: Informant interviews showed that Punjabi-speaking farmworkers preferred printed handouts, videos, and radio messages to receive COVID-19 related information. Participants preferred 8–1/2"x11" sized printed handouts that were colorful and had culturally relevant photographs. Participant video preferences included live action videos that were short (1–3 mins) with characters representing the Punjabi community. A substantial majority of focus group participants approved the newly developed COVID-19 educational and safety resources.

Conclusion: Current COVID-19 resources are not meeting the educational needs of Punjabi-speaking farmworkers. This community needs COVID-19 educational and safety materials that are culturally relevant and linguistically appropriate to be available in different formats: handouts, videos, and radio messages.

KEYWORDS

Agriculture; Punjabi; Punjabi-speaking farmworkers; COVID-19;; farmworker health and safety

Introduction


Because of the global COVID-19 pandemic, the farmworking community has faced increased health risks. In March 2020, the California Department of Public Health released an executive order that considered the employees of the food and agriculture industries to be essential and critical infrastructure workers.¹ A study conducted by researchers at the University of California, Berkeley School of Public Health reported that 13% of the 1,091 Salinas Valley farmworkers enrolled in the study tested positive for SARS-CoV-2, the virus that causes COVID-19.² Along with difficulties in practicing physical distancing at work, farmworkers have limited access to personal protective equipment (PPE), and share bathrooms and drinking fountains while at work.³ The

COVID-19 Farmworker Study highlighted how the current pandemic has exacerbated existing vulnerabilities farmworker communities endure in their living, working, and health conditions.⁴ For example, many farmworkers are systematically excluded from safety net programs, which further heightens their vulnerability to COVID-19.⁴

According to the 2019–2020 National Agricultural Workers Survey (NAWS) conducted by the United States Department of Labor, the majority (70%) of all agricultural workers are foreign born, with 63% of these workers born in Mexico and 5% in Central American countries.⁵ The estimates of farmworkers born in other countries were withheld because they were based on fewer than four observations.⁵ While the vast majority of farmworkers in the US are Latinx

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and speak Spanish, a small proportion of the farmworkers primarily speak Punjabi and are Sikh. As per the High-Country News report, a quarter of California's 200,000 Punjabi-Americans work in agriculture-related jobs.⁶ Further, approximately 3,000 individuals of Punjabi origin own farms on about 10% of California's 9.6 million acres of cropland.⁶ The Punjabi/Sikh community has played a significant role in the agricultural industry in the US. For instance, in Yuba and Sutter Counties, CA, Sikh farmers account for 95% of the peach farming, 60% of prune farming, and 20% of almond and walnut farms.⁷ Similarly, in Bakersfield and Fresno, California, 20% of the table grapes are produced by Sikh farmers.⁷

Because the Punjabi-speaking Sikh farmworking community plays a significant role in California agriculture, it is necessary to provide industry-specific health and safety resources for them. Previous studies have shown that building relationships with agricultural stakeholders improves the acceptance of educational materials. For example, the comprehensive needs assessment study conducted by Jones et al.,⁸ emphasized the importance of close collaboration with agricultural stakeholders for the development of industry-specific resources and information to enhance the reach of COVID-19 resources. In addition, LePrevost et al.⁹ conducted a descriptive study engaging Latino farmworkers in focused small group discussions, follow-up interviews to inform the development of resources, and assessment of symbols designed to improve pesticide safety. Agricultural stakeholders in these studies included farmworkers, farmworkers' families, agricultural employers, and government agencies such as Cal/OSHA and the California Labor Commissioner. The authors demonstrated the importance of involving farmworkers with limited reading and writing abilities in the development of pesticide safety curricula to ensure successful communication. A collaborative approach can mitigate the gap between the educational needs of farmworkers and the resources they are offered.¹⁰

Therefore, we conducted a study to understand the educational needs and preferences of Punjabi-speaking farmworkers in California through the use of in-depth informant interviews and focus

group discussions. The purpose of this study was to inform the development of agricultural industry-specific COVID-19 educational resources that are culturally competent and linguistically appropriate for Punjabi-speaking farmworkers. This study had the following four objectives: 1) to understand the COVID-19 educational needs of Punjabi-speaking farmworkers; 2) to assess the content, visuals, and cultural relevance of COVID-19 educational resources through key informant and focused group interviews; 3) to develop COVID-19 educational resources specifically for Punjabi-speaking farmworkers; and 4) to disseminate educational resources among Punjabi-speaking farmworkers through collaborations with community organizations, the Western Center for Agricultural Health and Safety (WCAHS), and representatives of the agricultural industry.

Materials and methods

Study location and study population

This study was conducted between January and May 2021 in Fresno and Yuba Counties, California with 20 Punjabi-speaking farmworkers. Yuba and Fresno Counties were selected as these counties have large Punjabi-speaking farmworker populations.¹¹ All of the participants recruited in the study were male. Five participants were recruited for key informant interviews, and 15 participants were recruited for the three focus group discussions (five participants in each focus group). Participants for key informant interviews were recruited through snowball sampling. In contrast, focus group discussion participants were recruited using flyers and recruitment postings that were placed at various Sikh temples and Punjabi grocery stores in Fresno and Yuba Counties. Eligibility criteria for key informant interviews and focus group discussions included: currently employed Punjabi-speaking Sikh agricultural workers in either Fresno or Yuba County, able to converse in Punjabi, any gender, and at least 18 years of age. The study was approved by the UC Berkeley Institutional Review Board (IRB Protocol ID # 2020-11-13,860). Verbal consent was obtained from all

participants prior to informant interviews and focus groups.

Study design and data collection methods

The key informant interviews and focus group sessions were conducted using discussion guides (see Supplemental File 1 and Supplemental File 2). Audio recordings were taken of the focus groups and informant interviews for transcription purposes. Participant responses/statements were not linked to identity. All electronic data were maintained on an encrypted device requiring a password for access.

Key informant interviews and development of resources

In Phase 1 of the study, five interviews were conducted with key informants to understand the

COVID-19 educational needs of Punjabi-speaking farmworkers and to assess the content, visual, and cultural relevance of currently available COVID-19 educational resources. All five interviews were conducted in-person in Fresno County using a semi-structured guide at a location convenient to the participants. The types of questions and topics asked in key informant interviews are listed in Supplemental File 1. The length of key informant interviews ranged from 30 to 45 minutes. The agriculture industry-specific COVID-19 educational materials created by the WCAHS for Spanish-speaking farmworkers were used to assess the cultural relevance and understanding among Punjabi-speaking farmworkers.

Based on the feedback from informant interviews, new COVID-19 educational resources were developed to specifically target Punjabi-speaking farmworkers in California. These resources

ਖੇਤਾਂ ਵਿੱਚ ਕੋਵਿਡ-19 ਤੋਂ ਸੁਰੱਖਿਅਤ ਰਹਿਣ ਦੇ ਤਰੀਕੇ

<p>ਸ਼ਰੀਰਿਕ ਦੂਰੀ</p> <p>ਇਕ ਦੂਜੇ ਤੋਂ 6 ਫੁੱਟ ਦੀ ਦੂਰੀ ਬਣਾ ਕੇ ਰੱਖੋ</p> 	<p>ਕੰਮ ਤੇ ਜਾਣ ਆਉਣ ਦਾ ਸਫ਼ਰ</p> <ul style="list-style-type: none"> ਗੱਡੀ ਵਿੱਚ ਸਫ਼ਰ ਕਰਦੇ ਸਮੇਂ ਗੱਡੀ ਦੇ ਖ਼ੀਸ਼ੇ ਬੰਦੇ ਰੱਖੋ ਇਕ ਦੂਜੇ ਤੋਂ ਵੱਧ ਤੋਂ ਵੱਧ ਦੂਰ ਬੈਠੋ 
<p>ਕੰਮ ਤੇ ਬਾਥਰੂਮ ਦੀ ਵਰਤੋਂ</p> <ul style="list-style-type: none"> ਬਾਥਰੂਮ ਦੇ ਦਰਵਾਜ਼ੇ ਅਕਸਰ ਠੀਕੇ ਹੁੰਦੇ ਹਨ ਬਾਥਰੂਮ ਦੀ ਵਰਤੋਂ ਤੋਂ ਬਾਅਦ ਆਪਣੇ ਹੱਥ ਸਾਬਣ ਅਤੇ ਪਾਣੀ ਨਾਲ ਧੋਵੋ 	<p>ਹੱਥ ਧੋਵੋ</p> <ul style="list-style-type: none"> ਆਪਣੇ ਹੱਥਾਂ ਨੂੰ ਚੰਗੀ ਤਰ੍ਹਾਂ ਸਾਬਣ ਅਤੇ ਪਾਣੀ ਨਾਲ ਘੰਟੇ ਘੰਟੇ 20 ਸਕਿੰਟਾਂ ਲਈ ਸਾਫ਼ ਕਰੋ, ਜਾਂ ਹੈਂਡ ਸੈਨਿਟਾਇਜ਼ਰ ਨਾਲ ਹੱਥ ਸਾਫ਼ ਕਰੋ 
<p>ਮਾਸਕ ਪਹਿਨੋ</p> <p>ਕੰਮ ਤੇ ਮਾਸਕ ਪਹਿਨ ਕੇ ਰੱਖੋ</p> 	

ਇਕੱਠੇ ਅਸੀਂ ਇਕ ਦੂਜੇ ਨੂੰ ਕੋਰੋਨਾ ਹੋਣ ਤੋਂ ਬਚਾ ਸਕਦੇ ਹਾਂ।

Figure 1. The practices that farmworkers can adopt to stay safe from contracting COVID-19 while at work in the fields. These practices include maintaining physical distancing, wearing face covering, washing hands frequently, and traveling safely to and from work.

ਕੋਵਿਡ-19 ਕੀ ਹੈ?

- ਕੋਵਿਡ-19 ਇੱਕ ਸਾਹ ਦੀ ਬਿਮਾਰੀ ਹੈ ਜੋ ਕਿ ਸਾਰਸ-ਕੋਵ-2 ਵਾਇਰਸ ਨਾਲ ਹੁੰਦੀ ਹੈ।
- ਸਾਰਸ-ਕੋਵ-2 ਇੱਕ ਕੋਰੋਨਾ ਵਾਇਰਸ ਹੈ ਜੋ ਕਿ ਸੱਬ ਤੋਂ ਪਹਿਲਾਂ 2019 ਵਿੱਚ ਪਾਇਆ ਗਿਆ।

ਕੋਵਿਡ-19 ਫੈਲਦਾ ਕਿਵੇਂ ਹੈ?

- ਕੋਵਿਡ-19 ਇੱਕ ਛੂਤ ਵਾਲੀ ਬਿਮਾਰੀ ਹੈ ਜੋ ਬੁੰਦਾਂ ਰਾਹੀਂ ਫੈਲਦੀ ਹੈ।
- ਇਹ ਉਦੋਂ ਫੈਲਦੀ ਹੈ ਜਦੋਂ ਕੋਈ ਸੰਕਰਮਿਤ ਵਿਅਕਤੀ ਖੰਘਦਾ, ਛਿੱਕ ਮਾਰਦਾ, ਬੋਲਦਾ ਜਾਂ ਸਾਹ ਲੈਂਦਾ ਹੈ।

ਕੋਵਿਡ-19 ਦੇ ਲੱਛਣ ਕੀ ਹਨ?

- **ਆਮ ਲੱਛਣ:** ਬੁਖਾਰ (100.4 F/38 C), ਖੰਘ, ਸੁੰਘਣ ਜਾਂ ਸਵਾਦ ਵਿੱਚ ਤਬਦੀਲੀ, ਸਾਹ ਲੈਣ ਵਿੱਚ ਤਕਲੀਫ਼, ਉਲਟੀਆਂ ਜਾਂ ਟੱਟੀਆਂ ਲੱਗਣਾ, ਨੱਕ ਵਗਣਾ, ਸਿਰ ਦਰਦ, ਥਕਾਵਟ ਹੋਣਾ, ਮਾਸਪੇਸ਼ੀ ਜਾਂ ਸਰੀਰ ਵਿੱਚ ਦਰਦ, ਗਲਾ ਦੁਖਣਾ, ਆਦਿ।
- **ਗੰਭੀਰ ਲੱਛਣ:** ਛਾਤੀ ਦਾ ਦਬਾਅ, ਸਾਹ ਲੈਣ ਵਿੱਚ ਭਾਰੀ ਤਕਲੀਫ਼, ਮੂੰਹ ਜਾਂ ਬੁੱਲ੍ਹਾਂ ਦਾ ਨੀਲਾ ਹੋਣਾ, ਜਾਂ ਜਾਗਣ ਵਿੱਚ ਅਸਮਰਥਾ

Figure 2. The basics of COVID-19, how it spreads, and the common symptoms of this illness.

included printed handouts (Figures 1–4), videos, and radio messages. The printed handouts were created using Canva, an online graphic design tool, in Gurmukhi Punjabi, one of the several scripts used to write the Punjabi language. The video messages were recorded on a computer in Punjabi. The radio messages were recorded in Punjabi using the voice memos application on a phone. In total, we created four printed handouts (Figures 1–4), two short video messages, and two short radio messages. These newly created resources were shared with participants to gain feedback during the second phase of the study: focus group discussions.

Focus groups

In Phase 2 of the project, three focus groups were conducted with five participants in each group. Focus groups provided participants an opportunity to exchange multiple viewpoints and discuss disagreements regarding the resources created. One focus group was conducted in Yuba County and the other two were

conducted in Fresno County. The focus groups took place over the participants' lunch hour or when their schedule allowed. All eight resources were shared with each of the focus groups. A semi-structured discussion guide was used to structure the conversation about the newly developed audio and visual COVID-19 educational resources. The types of questions and topics asked in the focus groups are listed in Supplemental File 2. All focus groups were conducted outdoors: two on farms and one in a park. The length of the focus groups ranged from 45 to 60 minutes. COVID-19 physical distancing requirements were followed for all interviews and focus groups.

Theoretical framework

Multiple theories helped inform the development of agricultural industry specific COVID-19 educational resources for Punjabi-speaking farmworkers in California. Specifically, the grounded theory, which was selected as it generates a “unified



Figure 3. The practices that farmworkers can adopt at work to stay safe from contracting COVID-19. These include washing hands frequently, maintaining physical distancing, and wearing face coverings.

theoretical explanation” for a process or an action,¹² was employed to generate theories about the COVID-19 related educational needs of Punjabi-speaking farmworkers through the use of the key informant interviews and focus group discussions described above.

This study also drew on social ecological theory. Social ecological theory emphasizes the dynamic interplay between situational and personal factors, along with focusing on environmental or behavioral determinants of well-being.¹³ This model is well-

sued for the present study as it focuses on the unique situational challenges farmworkers face and how these challenges lead to increased transmission of COVID-19 at the individual, community, and societal levels.

Data analysis

Data analysis was conducted simultaneously with data collection. The data, including notes, annotations, codes, and transcripts, were organized using



Figure 4. Modified with permission from a resource created by the California Strawberry Commission. The original text was translated into Punjabi. The figure highlights the importance of washing or sanitizing hands after interaction with commonly touched items such as phones, chairs, and bathroom doors.

standard programs including Microsoft Word and Google Docs. The analysis followed a four-step process: immersion, coding, creation of categories, and identification of themes.¹⁴ For the immersion of data phase, the research team, consisting of three individuals, read and re-read interview transcripts and listened to interview recordings. The second stage of analysis involved coding of informant interviews and focus group discussions. Two members of the coding team initially coded the data separately, then compared, discussed, and reached agreement on differences in code

meanings and emerging patterns.¹⁴ The goal of coding was to “fracture the data” and rearrange it into categories that facilitate comparisons between topics in the same category and between categories.¹⁵ Both pre-determined and open coding strategies were employed. Based on our analysis of the five informant interviews, a list of anticipated codes was created using inductive approaches. The third stage of analysis was the creation of categories. This was achieved by linking codes to create coherent categories. The fourth stage of the analysis was the identification of

themes, which helped link the results from interviews to what we know about people in other settings.¹⁴

Results

Key informant interviews

A total of five key informant interviews were conducted with Punjabi-speaking farmworkers in Fresno County. All participants were male and identified as Punjabi-Sikhs. They all spoke Punjabi as their primary language. The project team did not collect any further demographic data from these participants. Based on the interviews, a codebook was created, which contained codes with their categories, descriptions, and examples from the data collected through informant interviews.

Participants' experience with COVID-19 education and reference materials

All participants had some knowledge regarding COVID-19, which was primarily obtained from television, family members, friends, and healthcare providers. None of the participants reported receiving information regarding COVID-19 in Punjabi from their employer. There was unanimous interest in receiving additional COVID-19 education and safety information. One participant stated the following:

Anyone can provide us information—it is good for us and our health. It is important for us to stay healthy.

Key themes regarding material preferences

All participants shared a preference for printed handouts to learn more about COVID-19 and safety practices. There was a heavy reliance on receiving COVID-19 information through posters and handouts displayed in public places, such as Punjabi grocery stores and Sikh temples. A substantial majority of the participants preferred handouts, posters, videos, and radio messages as a source of additional information. There was very limited interest in receiving information through workbooks and photo novels.

Participants' preferences for print materials

All participants unanimously agreed on the standard printer paper size (8-½" x 11") as their preferred printed resource. The participants had a strong preference for culturally relevant photographs of farmworkers to be used in the printed materials. One participant stated the following:

...if the pictures can show someone of Punjabi background wearing a turban that would be good. I do not like cartoons in printed materials ...

Further, all participants shared the preference for resources to have limited text. Following are some responses that participants shared:

Approximately 50% photographs and 50% text. The pictures should explain what is written in the text.

Half text and half pictures are fine.

More pictures are better.

Lastly, all participants mentioned the preference for colored handouts compared to black and white handouts. However, there was no preference for the types of colors to be used.

Key themes regarding video and radio resources

All participants unanimously found radio and video messages in Punjabi to be helpful. They all shared preference for video characters that speak Punjabi and represent the Punjabi community. Following are responses they shared:

...it is better if people in the video are wearing turbans.

...videos of Punjabi people practicing safety, I would find them more relatable and helpful.

Similarly, live action videos with real people were given heavy preference over animated safety videos. One participant noted:

"I do not like cartoon illustrations." This sentiment was shared by other participants as well who agreed unanimously with this statement.

The preference for length of video or audio safety messages ranged from one to three minutes among participants. There was a general consensus that shorter videos on health and safety are preferred.

Focus groups with farmworkers

A total of 15 farmworkers participated in three focus groups. There were five participants in each group. All focus group participants were male, identified as Punjabi-Sikhs, and primarily spoke Punjabi. One focus group was conducted in Yuba County, and two focus groups were conducted in Fresno County. The project team did not collect any further demographic data from these participants. Table 1 shows a summary of the focus groups. The new COVID-19 education materials (i.e., Figures 1–4, short videos, and radio messages) shown to the focus group participants were created using feedback from key informant interviews.

Focus group participants shared similar preferences for educational materials on COVID-19. A substantial majority of participants preferred printed handouts, safety videos, and educational messages on the radio. However, a few participants shared their frustration with being unable to search for and use safety videos to inform themselves. The unfamiliarity with using phones and the inability to search for safety videos in English were commonly mentioned as barriers to accessing information on their phones. Following are their responses:

I like videos, but I have difficulty using them, so I prefer to hear messages on the radio.

I do not use a smartphone and don't know how to access safety videos.

Printed handouts

We elicited participant feedback on the newly developed handouts on COVID-19 education and safety. There was an overwhelmingly positive response to the developed handouts (Figures 1–4). The following are a few comments from the participants when asked what they thought of the printed resources:

“These are really good. I would have liked these resources in the early days of the pandemic. There were no written resources shared with us in the early times of the pandemic.” Other focus group members unanimously agreed with this statement.

The Punjabi writing is good. I like the representation of my community members in these resources.

The pictures complement the written messages...we approve these printed materials.

I usually read with glasses, but I can read these resources without them. I like the big text.

All the focus group participants agreed that the colorful printed materials in Punjabi met their educational needs. There was unanimous agreement on the use of a larger font for resources and using photographs of community members working on the farm (compared with the use of cartoons/illustrations). One specific recommendation from a focus group participant was to include summary statements or key points at the end of every handout.

Videos

The focus group participants were shown two short videos made in conjunction with WCAHS on COVID-19 vaccine safety and side effects. The researchers asked participants questions on content, video format, length, and cultural relevance of the video. As with the printed handouts, support for video messages was overwhelmingly positive. Following are a number of responses participants shared:

The information in the videos was very good

They were easy to follow and concise

...like that the videos were short. If they are too long, then the person gets lost. It's better to tell the main point.

Most of the people who work in the farms are not formally educated. No one speaks English. If the videos are in Punjabi, it is better.

Table 1. Summary of focus groups (N = 15).

Focus group number	Language spoken during focus group	Males n (%)	Females n (%)	Location	Region
1	Punjabi	5 (100)	0 (0)	Peach Farm	Yuba County
2	Punjabi	5 (100)	0 (0)	Grape farm	Fresno County
3	Punjabi	5 (100)	0 (0)	Local Park	Fresno County

The video was nice too since it had a person with a turban sharing the information with us— we're more inclined to listen to such messages.

All participants agreed if similar videos were shared among the Punjabi-speaking community, they would be well-received and found to be useful.

Radio messages

The focus group participants listened to two radio messages in Punjabi that were translated from the Centers for Disease Control and Prevention website. These messages were titled “Everyday COVID-19 Prevention Actions” and “Coronavirus Stops with Me.” The participants were subsequently asked questions on content, length, and cultural relevance of the audio messages. Similar to the video messages, all participants unanimously found the radio messages to be informative and helpful. The following are a few of the responses shared by the participants:

...if this information was shared before, this [coronavirus] wouldn't even spread. We didn't really know before ...

We would like to hear such messages on the radio. I keep my radio on all the time—in my car and at home.

[These messages] make you become more aware of your surroundings and take necessary precautions early.

We liked all the resources you created. They're not just for farmworkers—any of our other brothers who read them would find them beneficial.

As with the videos, all participants in all focus groups agreed that the radio messages were likely to be well-received by the Punjabi-speaking farmworkers.

Other unexpected findings

On several occasions during the focus group discussions, the topic of masks came up. Many participants endorsed wearing masks at work and in public spaces. However, a substantial majority of participants shared their frustration with putting a mask on with a turban. The majority of key informants and focus group participants suggested that the

government, clothing stores, and employers make and share masks that can be tied over their turbans.

Discussion

This study engaged with Punjabi-speaking farmworkers in Yuba and Fresno Counties. Other stakeholders included various Sikh temples and Punjabi grocery stores in Fresno and Yuba Counties, as well as Punjabi Radio stations. Our findings indicated Punjabi-speaking farmworkers have unique educational needs that merit culturally relevant resources to be available in Punjabi. Therefore, based on the key informant interviews, we created tailored resources in Punjabi related to COVID-19 prevention in agriculture. Interviewees preferred standard paper size handouts (8-½” x 11”), short live action videos (1–3 minutes), and radio messages. Overall, the participants shared positive feedback on the cultural relevance and linguistic appropriateness of the newly created resources. There was a unanimous consensus that these resources would be well-received by the Punjabi-speaking farmworker community, if shared with them. Below, we discuss the resources individually.

The four printed materials designed for this study were colorful, used photographs of real Punjabi farmworkers, and used limited text (Figures 1–4). The participants unanimously approved of the use of photographs of actual Punjabi farmworkers and had a strong preference against the use of illustrations. The COVID-19 Statewide Agriculture and Farmworker Education (SAFE Program) Final Report describes a strong preference for pictures that represent the target audience, and the program utilized photographs in both print and digital outreach campaigns,¹⁶ this suggests alignment between the largely Latinx audience of the SAFE Program with the Punjabi farmworker audience of this study. However, *fotonovelas* (comic books) and *rotfolios* (flip charts) have been successfully used to educate Spanish-speaking farmworkers on topics ranging from HIV/AIDS to chemical safety and diabetes. When presented with examples of these resources, the Punjabi-speaking farmworkers in our study were unequivocal in their dislike of illustrated images. Further research should investigate

whether and when there are deviations from this preference. For example, the preferred way of illustrating a challenging concept, such as for scenarios that would involve putting someone in a dangerous occupational situation, should be investigated. It would be relevant to determine whether a hybrid between photography and illustration or graphic design could be utilized to convey occupational hazards effectively yet still have the necessary cultural relevance. Similar systematic evaluation of outreach and education preferences should be carried out for all farmworkers; while more is known about Spanish-speaking farmworkers, it is largely anecdotal and based on common practices rather than systematic query.

Punjabi-speaking farmworkers also approved of using short videos of 3–5 minutes consisting of a Punjabi-speaking person presenting COVID-19 health and safety information. These short videos allowed for the COVID-19 health and safety information to be accessible when literacy is an issue. However, a challenge was highlighted by some of the interviewees. They reported that they did not have or know how to use their smartphones to search for health videos in Punjabi effectively.

Dispersal of these videos and materials is something that must be considered. To minimize the challenge for those without smartphones, a proposed solution would be to play the videos on the television screens at Sikh temples and Punjabi grocery stores. Given that recruitment strategies for this study were put into practice at these locations, dispersing the videos here would reach the same audience. This would allow for greater accessibility for those without phones, access to social media, and lack of familiarity with smartphones.

Another challenge was for those needing help locating the videos given the English standard smartphone keyboards. A proposed solution would be distributing flyers with QR codes to farmworkers. This would eliminate the need for the Punjabi keyboard and would automatically load the videos onto their screens. A limitation of this proposed solution is that explaining this to the older Sikh Punjabi-speaking audience would be complex.

Radio messages are commonly used to communicate health and safety information to agricultural

workers across the US and are generally well-received.^{17,18} Similarly, all participants in the present study found radio messages to be helpful and informative. Most interviewees endorsed listening to Punjabi Radio USA while driving or while spending leisure time at home.¹⁹ Fresno County Punjabi farmworkers reported listening to 1300 AM and 104.5 FM radio channels, while similar information was obtained through 1450 AM and 96.5 FM radio channels by Yuba County Punjabi farmworkers. Punjabi-speaking farmworkers can listen to Punjabi Radio USA, via a radio (either in the car or at home), the free mobile app, or dialing the radio number on the phone, making it an accessible source of information.¹⁹ Compared with video messages, radio messages were easier for Punjabi farmworkers to consume, and some informants suggested that they frequently listened to the radio, strengthening support for this form of communication. This can be another method to make information available when literacy is an issue.

Limitations

Our findings provide strong preliminary results for the creation of culturally relevant agricultural health and safety resources for Punjabi-speaking farmworkers; however, our work has some limitations that should be addressed in future studies. Specifically, this study included only a small number of study participants, which makes it difficult to generalize these findings to all Punjabi-speaking farmworkers in California. In addition, no interviews were conducted with women farmworkers, which is likely due to the prevalence of male Punjabi farmworkers. Additional research should include Punjabi-speaking women, most of whom work in food processing plants and packing companies in the Central Valley. This critical gap can be filled by conducting further research to determine whether Punjabi-speaking women working in agriculture have different opinions regarding educational resources.

Another limitation of this study is that interviews with key informants were conducted only in Fresno County. Though the focus group discussions were conducted in Fresno and Yuba Counties, there may be substantial variability

among farmworkers in other counties of California and across the United States. Additional research should recruit participants from other counties in California as well as elsewhere in the United States to increase generalizability and the scope of the research findings.

Limitations may also exist in the interviewer's approach used during data collection, which may have inadvertently omitted important topics. In addition, interviewer flexibility in sequencing and wording questions during semi-structured interviews could result in different responses from different perspectives, thus reducing the comparability of responses. However, the findings from this study provide a valuable starting point for future research with Punjabi-speaking farmworker communities as well as produced well-received COVID-19 prevention resources ready for distribution to Punjabi-speaking farmworker communities. Our findings can be applied to other safety resources developed for Punjabi-speaking farmworkers to ensure their health and safety in the workplace.

Recommendations and next steps

The major themes in our analysis provide critical information on specific communication, information, and response needs within the agricultural industry. We recommend incorporating the preferences of Punjabi-speaking farmworkers in any future resources that are developed for this community.¹⁰ In addition, we recommend state and federal occupational health and safety agencies hire additional Punjabi-speaking staff members to bridge the knowledge gap among minority farmworkers.

The resources developed for this study will be shared via the WCAHS website and YouTube channel. In addition, copies of the print resources will be given to local grocery stores and Sikh temples to reach farmworkers that do not use electronic devices or social media.

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Data availability statement

Raw data that support the findings of this study that are not included in the manuscript and supplemental files are available on request from the corresponding authors, As and KP. The data are not publicly available to maintain privacy of the research participants.

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