Evaluation of Educational Material for Low-Literacy Populations in India

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Abstract

During the COVID-19 pandemic, many children from limited-literacy communities in India did not receive information regarding COVID-19 safety due to the sudden shutdown of schools. Many parents from these communities could not afford virtual learning and lacked the ability to educate the children themselves. In July 2021, the research team developed comic, coloring, and activity books to provide children with fun, yet readable, educational materials. We consulted with teachers to simplify the language and understand the popularity of different cartoon characters. Between August 2021 and January 2022, our community health partners distributed the books to two age groups, ages 6–10 (n = 116, mean age 8.72) and 11–14 (n = 81, mean age 12.05). We conducted surveys with the children during and a week after distribution to assess any change in their knowledge about COVID-19 safety. The average age of children in this study was 10.09 (SD = 2.01) years. All resided in underresourced urban communities with low literacy rates and limited education. All questions were answered more correctly in the postsurvey, with the social distancing question having the greatest and most statistically significant increase (33.6%, $p < 0.0001$). The average increase in knowledge among children aged 6–10 (16.9%) was greater, though not statistically significantly so, than the average increase among children aged 11–14 (4.7%). These results indicate that child-friendly books can increase health education for children ages 6–14 in low-literacy populations. Additionally, the mechanism of the program is fit to be used in other low-resource populations globally.

The COVID-19 pandemic caused many countries around the world, including India, to go into lockdown (Verma et al., 2020). This lockdown consisted of shutting down schools and jobs while forcing residents to stay within their houses. Stay-at-home orders led to many negative consequences, such as adults losing employment and students losing the continuity of their education. Students from underserved, underresourced communities lacked the resources to attend online virtual learning (Alvi & Gupta, 2020). Additionally, many students in India did not adapt to virtual learning for other reasons, such as doubting the usefulness of online education and the lack of personal interaction between the students and the teacher (Arora & Srinivasan, 2020). These adverse conditions deeply affected students from some communities by preventing them from being able to receive necessary education about important health topics, such as COVID-19 (Mistree et al., 2021).

While in school, students tend to connect with their teachers and learn under their guidance. Many students rely on teachers as their primary source of motivation and as the primary channel through which they receive knowledge (Thoonen et al., 2011). However, many children have difficulty learning educational material independently without in-person teaching and assistance. Furthermore, learning outside the classroom setting presents additional obstacles, such as a lack of peer interactions and a loss of motivation and interest (Lathabhavan & Griffiths, 2020). In addition, especially in underserved, low-literacy populations, students cannot read intensive literature and receive guidance from their parents or caregivers due to the latter's lack of formal education. One method to connect with children and help them understand more about COVID-19 may be children's books with interactive and engaging activities. Previous research has shown that improving health outcomes through educational interventions is possible (Schillinger et al., 2006).

Any educational program for children must be tailored according to their living situations and the potential barriers they may face in absorbing the information provided. Currently, there are many

books about health topics. Books that children in low-literacy populations would appreciate the most are the ones that are relatable and have enjoyable qualities, such as stories and activities (Graham, 2011). Other formats such as leaflets and posters have been previously researched in teaching students (Hasanica et al., 2020). Leaflets were found to be an ineffective way of promoting health education. On the other hand, posters are considered effective, but primarily for larger populations (Hasanica et al., 2020). Additionally, the demonstrated effects of both methods had no or low statistical significance, so the researchers who investigated them recommended looking for alternatives (Hasanica et al., 2020).

Comic books are a unique way of promoting health education, as they connect with children and effectively convey information (Dalacosta et al., 2009). Comics are highly entertaining for children, and the characters play an important role in making learning fun. Using comics to promote education has been helpful for children from low-literacy populations because they learn more from pictures than from words (Negrete, 2013). When children are required to digest a large amount of information, reading becomes challenging (Topping, 2015). For this reason, comic books are made to convey information with less text and attractive pictures. This type of educational distribution allows children from low-literacy populations to gain the education they might not be able to receive otherwise.

In addition to reading comic books, engaging with interactive content such as activities can stimulate learning on topics like COVID-19 (Bitz, 2004; Inharjanto, 2020). Engaging children through artwork has been a positive contributor when promoting health education. In Malaysia, artwork was shown to be an effective way to create awareness among and prepare people for COVID-19 (Ong & Lee, 2022). Lastly, research done with Teach for America, an organization meant to provide education for underresourced populations, found that incorporating familiar cartoon characters and superheroes in lessons was vital to attracting and maintaining children's attention. Children look up to superheroes as role models, which can positively influence their behaviors and attitudes (Trujillo & Scott, 2014). These are important aspects to consider when designing a program's vehicle of education.

Several studies have evaluated the effectiveness of different methods of teaching children from low-literacy populations. One study found that focusing on educating the whole family was more effective than focusing on an individual in a family. Additionally, the study ensured that instructors were well-trained and considered the family's health and financial inequities to provide education with situational context (Kasper, 2021). Another study found that improving health literacy in a community can decrease people's concerns about the COVID-19 vaccine (Rehati et al., 2022). Longer interventions that introduce concepts and scientific reasoning have proven more effective in educating children than quicker, targeted methods with limitations (Mistree et al., 2021). Furthermore, a study by Neuman and Celano (2001) found that students from underserved low-literacy communities require access to affordable education and educational material. Lastly, Kost et al. (2017) studied the effectiveness of collaborating with local community partners to facilitate research, promote health education, and enhance the availability of information. The collaboration allowed for greater engagement between scientists and the community, allowing them to provide resources that the community could not otherwise access.

In response to the break in education for Indian youth during the COVID-19 pandemic and inspired by the programs and educational resources published in the literature, we developed an initiative to educate youth from low-literacy populations in Mysore, India, about COVID-19. We designed the program to facilitate easy retention of information by providing children with coloring, activity, and easy-to-read comic books. This project aimed to provide important health education in a time of great need and to assess the effectiveness of coloring, activity, and comic books in teaching children about COVID-19. We also wanted to collaborate with local community partners to provide simple, effective, and sustainable solutions to address issues with access to health education.

Methods
Study Location
This study was conducted in the Mysore Taluk (township) of Mysore district, where the total population is 1,281,768 according to the 2011 census (Census India, n.d.). In this Taluk, about 25.7% of the population lacks any formal education. For every five residents, one (20.32%) is designated as a member of Scheduled

Castes or Scheduled Tribes, who are historically disadvantaged socioeconomic groups. These groups form the majority of India's lowest socioeconomic bracket (Chandramouli, 2011).

Our local community partner for this program was the Public Health Research Institute of India (PHRII), a research, training, and health services–based nonprofit organization working to improve health care access, capacity building, and community health education in underserved communities in the Mysore district. Its operations began in 2007 and its catchment area covers the city of Mysore, peri-urban areas around the city, and 144 villages. Within Mysore city, PHRII works with low-income groups mostly situated within underresourced urban communities. It primarily focuses on women and children and provides health services and educational outreach activities in hard-to-reach areas. Our study team consisted of community-based research experts, outreach workers, local health educators from PHRII, and health promotion researchers from the University of Arizona, United States, with expertise in underresourced populations.

This program was carried out in three low-income and low-literacy neighborhoods (Ekalavyanagar, Kuduremala, and Amruthabadavane) in Mysore, where PHRII had previously worked and built rapport. These neighborhoods are considered underresourced urban communities because they are located within the city but face a myriad of social inequities. Children from these communities often have limited access to education and are of poor health and low nutritional status, and their parents generally work long hours in low-paying jobs (Kulsum et al., 2008). Residents from these these neigborhoods face several common morbidities, such as acute respiratory tract infections, diarrhea, and high rates of cardiovascular disease (Kumaret al., 2013; Krupp et al., 2020). Additionally, children in these neighborhoods have a lower standard of living compared to average children in india in terms of health and housing compared to children from other urban communities, and they tend to begin working in childhood to provide revenue for their families (Sandeep & Komala, 2015).

This paper evaluates a health promotion program for children in these communities. We intended to take a collaborative approach in developing this community-based program. Thus, we attempted to incorporate community members' perspectives at every stage by following the different levels of community engagement per the International Association for Public Participation (2017). We combined the five different aspects of engagement in community projects: inform, consult, involve, collaborate, and empower.

Ethics and Consent

The study was reviewed and approved by the Institutional Review Board of the PHRII (IRB Approval #2022-02-21-67). The Institutional Review Board of the University of Arizona reviewed this submission and determined that it would not need to undergo IRB review in the United States. All parents provided oral informed consent before their children participated in the program.

Development of Educational Material

We developed educational material including activity, coloring, and comic books to engage children in fun and entertaining ways. The activity book consisted of different puzzles, such as a maze and a word search. The coloring books had outlines of different characters, and the reader could color within the lines. Lastly, the cartoon books portrayed a story that informed children about different aspects of COVID-19. We asked children for feedback to improve the final iterations of the books and assessed their changes in knowledge to learn if the books conveyed the necessary information about COVID-19. We created three types of books in order to reach a range of students between the ages of 6 and 14.

We decided to split the children into two age groups: 6–10 and 11–14. Those age groups were carefully picked, as children in India between ages 6 and 10 are in elementary school while children between ages 11 and 14 are primarily in middle school. We aligned our age groups with the Indian school system, as elementary school children would have similar interests that would differ from those of middle school children. We consulted with schools to choose the correct age range and saw that children ages 5 and younger were not able to comprehend the material, while children 15 and older tended to have substantial knowledge about the pandemic from external sources, including the media and the internet. Additionally, previous research has supported that children can start reading successfully at age 6 (Durkin, 1968), and most of their development occurs between the ages of 6 and 14 (Eccles, 1999). For these reasons, we decided to choose these age groups.

When consulting with the schools, elementary and middle school teachers said that their students enjoyed reading comic books. However, elementary

teachers incorporated much more coloring and drawing in their curriculum than middle school teachers did. Additionally, during the literature review, several sources discussed elementary and middle school students benefiting from using comic strips to learn (Maulana & Fitrawati, 2017; Özdemir, 2017). However, coloring and activity books have been primarily used by elementary students (Mutya & Isyam, 2013). For this reason, we chose to give the elementary students coloring, activity, and comic books, whereas the older students were only given comic books.

Before we developed the books, children were consulted at two stages to ensure that the books' material was engaging. In the first stage, we informally spoke to children of PHRII staff to understand if or to what extent COVID-19 education was taking place in their schools. We briefly asked them questions to gauge their understanding of the disease and associated health behaviors. Furthermore, we asked them to list their favorite cartoon and movie characters to help us choose which ones we should incorporate into our books. In the second stage, we worked with PHRII to incorporate COVID-19 material into the books in a simplified manner and to translate them into the required dialect of Kannada. Subsequently, we invited a few children from both age groups to engage with drafts of the books and requested feedback regarding their interest in and ability to read the books. We incorporated the feedback into the final versions of the books, improving their overall quality.

Book Distribution and Data Collection

Many students stayed home from March 25 to May 31, 2020, because of India's COVID-19–induced lockdown (Basu et al., 2020). Even after the lockdown, schools remained closed due to high rates of COVID-19 throughout the country. Schools reopened at different rates depending on their location, but most did not stay open for more than a couple of months, as further waves of COVID-19 caused more lockdowns and shutdowns of schools (Sharma & Joshi, 2021). It was not until the end of 2021 and the beginning of 2022 that schools started reopening and staying open (Kuchay, 2021).

PHRII reached out to community health workers (CHWs) known as Accredited Social Health Activists (ASHAs) to engage with this program. ASHAs, themselves, are community residents who serve as the first point of contact of community members regarding concerns related to children's health (Ministry of Health & Family Welfare Government of India, n.d.). They have good relations with families in the community and the ASHAs we worked with were willing to help identify children of the selected age groups and distribute the books. They also helped provide parents or guardians with instructions on how they could support their children in completing the books.

For 6 months, the study team and CHWs went to houses throughout three neighborhoods and distributed the books to two age groups, ages 6–10 (n = 116, mean age 8.72) and 11–14 (n = 81, mean age 12.05). Before providing the books, they asked for verbal consent from the parents or guardians to ensure they felt safe receiving the survey and educational material. Then they provided a pre-survey before handing each child a book and crayons. Parents were asked to support their children by providing directions to complete the activities and helping them understand the content of the information when needed. It was emphasized to the parents that they should motivate the children but allow them to complete the books independently. Additionally, the PHRII team provided CHWs with crayons to give to the children to use with the books to ensure that they could color in the books without worrying about purchasing the crayons. After a week, a post-survey was conducted, and a sports cap was given to each child upon completion of the survey.

Interview and Surveys

In total, 116 children from the younger age group and 81 from the older age group and their families verbally consented to each step of the process: the pre-survey, receiving the books, and the post-survey. Each child who completed a pre-survey was assigned a unique ID to de-identify the respondent. Afterward, the children were interviewed face-to-face, and the interviewer answered any follow-up questions from the children. Before the books were distributed, we surveyed children's baseline knowledge about COVID-19 and their level of excitement about receiving the books. A week later, we conducted post-surveys with children who completed the activities in the books to assess their change in knowledge and to receive further feedback about the books. During the week, we called parents or asked CHWs to visit their houses to check in on the children's progress and answer any questions. Upon completion of the books, each child was gifted a sports cap.

The surveys asked questions about COVID-19 related to social distancing, protecting oneself from the virus, symptoms, and the ways the virus can spread. It also asked questions aimed to assess how the children felt about books, such as what types of books they preferred. Additionally, in the survey, we assessed the children's interest in different aspects of the books. Lastly, the interviewer noted how the children felt about the books and any specific reactions, such as tone, mood, and facial expressions. After a week, the team reconnected with each child to complete a post-survey to assess change in their knowledge of the same topics. Additionally, the post-survey contained questions about which books were their favorites, the cartoons they liked the most in the books, and their favorite features of the books. A Likert-type scale with emoticons using various facial expressions was shown to the children to help them express their liking for the books, as shown in Figure 1. This was then translated to a score of 1–5, with 5 being the highest liking for the books.

Statistical Analysis

Data was collected in paper form and entered into Microsoft Excel. It was then analyzed using Stata version 16.1. Basic descriptive statistics were conducted using two-by-two contingency tables comparing the pre- and post-surveys for each question. This was done separately for the younger and older age groups. Differences between pre- and post-sessions were assessed using McNemar's chi-square test (to account for correlation between each participant's pre- and post-intervention surveys) or, as appropriate, its exact test equivalent. Additionally, differences in the total number of correct responses to the five key questions were compared using a paired t test. All associations were considered significant at the alpha = 0.05 level.

Results

From July 2021 to December 2021, three types of books (comic, coloring, and activity) were distributed to three of the 69 underresourced urban neighborhoods in Mysore City and reached 116 children between the ages of 6 and 10 and 81 children between the ages of 11 and 14. A total of 197 children completed the pre- and posteducation surveys. The mean age of the younger group was 8.72 ($SD = 1.26$) and the mean age of the older group was 12.05 ($SD = 1.02$).

Based on our comparison of data between the pre- and post-surveys, there was an overall increase in the number of questions answered correctly, as shown in Table 1 and Figure 2. In the younger age group, there was an overall increase in correct responses by 26.56%, while in the older group, there was an increase of 5.08%. The largest increase was for the 6–10 age group, with a 33.6% increase in the number of questions answered correctly about social distancing ($p < 0.0001$). Other questions that had a significant improvement in correct responses were about COVID-19 symptoms (17.2% improvement in ages 6–10, $p < 0.01$), ways of protecting oneself (16.4% improvement in ages 6–10, $p = 0.0001$), and the purpose of vaccines (14.7% increase in ages 6–10, $p = 0.0082$). Among children ages 11–14, none of the increases in correct responses reached statistical significance, although the increase in correct answers to questions about the best way to prevent oneself from getting COVID-19 was close ($p = 0.0654$). Overall, there was an increase in the mean number of correct responses among children ages 6–10 (3.18 vs. 4.02, $p < 0.0001$) and among children ages 11–14 (4.62 vs. 4.84, $p = 0.0038$).

Our survey asked the children how much they liked the books. Among children ages 6–10, the average rating was 4.5 out of 5 upon initially receiving the books. Before accepting the books,

**Figure 1.** Likert-type Scale With Emoticons and Numbers for Low-Literate Groups

Table 1. Correctly Answered Responses in the Pre- and Post-Survey by Age Group

Survey questions	Correct responses in pre-survey		Correct responses in post-survey		Percentage change	p
	n	%	n	%		
Ages 6–10						
What do you feel if you have a Coronavirus infection (mark the correct one)?	58	50	78	67.2	17.2	0.0051
Can you name at least 2 ways that have not already been mentioned above to protect yourself from Coronavirus?	87	75	106	91.4	16.4	0.0001
How far should you stand away from each other to avoid getting Coronavirus (mark the correct one)?	26	22.4	65	56.0	33.6	< 0.0001
What is the virus that has been making a lot of people sick for the past one and a half years?*	111	95.7	114	98.3	2.6	0.25
What is the best way to prevent yourself from getting Coronavirus infection (mark the correct one)?*	87	75.0	104	89.7	14.7	0.0082
Total # Correct	Mean (SD): 3.18 (1.1)		Mean (SD): 4.02 (0.96)		Mean (SD): 0.81 (1.23)	< 0.0001
Ages 11–14						
What helps protect you from COVID-19 (choose one)?	79	97.5	81	100.0	2.5	0.5000
What is one of the ways Coronavirus can spread?	69	85.2	74	91.4	6.2	0.1655
Can you name at least 1 more way that has not already been said to protect yourself from Coronavirus?	78	96.3	81	100.0	3.7	0.25
What is the virus that has been making a lot of people sick for the past one and a half years?*	79	97.5	81	100.0	2.5	0.5
What is the best way to prevent yourself from getting Coronavirus infection (mark the correct one)?*	69	85.2	76	93.8%	8.6	0.0654
Total # Correct	Mean (SD): 4.62 (0.75)		Mean (SD): 4.84 (0.46)			0.0038
* These questions were asked to both groups.						

66.7% of children showed verbal interest, such as saying that they were excited about the coloring and interested in the cartoon characters. After reading the books, children gave an average rating of 4.7, with 70.1% of children in that age group preferring coloring books over activity books and comic books. Most children had an overall appreciation for incorporating popular characters, coloring, and activities in the books. Among the children ages 11–14, the average rating was 4.7, and 56.1% of children showed verbal interest in the books upon recept. After reading the books,

Figure 2. Questions With a Significant Increase in Correct Responses After Completing the Books
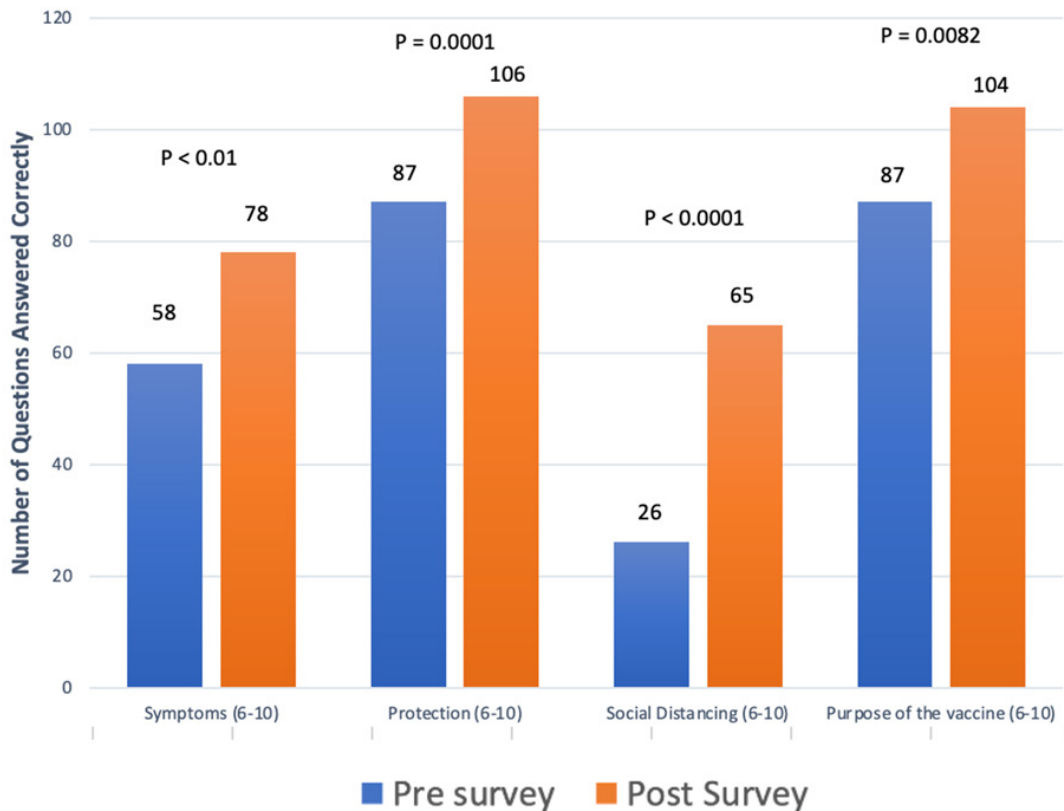
their overall rating did not change, but a majority enjoyed the comic books.

Discussion

This study evaluated an educational program that aimed to increase understanding of COVID-19 among youth from low-literacy populations in Southern India. Previous research has been conducted on the use of comic, coloring, and activity books as educational tools in schools (Ausekle & Šteinberga, 2011; Habib & Soliman, 2015; Shigehatake et al., 2014). However, very little evaluation has been conducted on these tools as a vehicle for low-literacy populations worldwide. Since COVID-19 had a major impact on India, it was necessary to create a smaller model to assess the value of such programs. Additionally, there was limited literature on educating youth about COVID-19 in communities with low literacy rates. Therefore, creating illustrated children's books was a great way to engage and connect with youth while educating and instilling a sense of importance about a global pandemic.

When talking to community members and teachers from the Mysore community, we identified potential hardships that could limit health education among the children from the low-literacy population. Consequently, we adjusted the program to increase the books' effectiveness and reach. For instance, many teachers talked about how children like science books with cartoon characters. However, they expressed that the characters often had to be from popular TV shows and movies to make an impact on the children. For this reason, we added characters from shows that the children frequently watched, including *Chhota Bheem* and *Little Singham*. Most of the positive feedback from the children in our program revolved around how much they liked the artwork in the books. They felt more excited to learn about health because they also saw their favorite cartoon characters being a part of it.

Our results align with previous research on comic books being an effective medium for promoting health education (Branscum & Sharma, 2009). We were also concerned about children

from low-literacy backgrounds having difficulty reading the books. We overcame literacy barriers by conveying the information with illustrations rather than text and by adjusting the limited language used in accordance with readers' literacy level. For example, instead of "virus," "bug" was a common word that was used.

Furthermore, we were worried that children would struggle without the support their teachers usually provide while learning. Because parents are key influencers among children of these age groups, we carefully instructed parents and caregivers about the books and how best to help their children engage with them (Anderson & Cavallaro, 2002). We also made follow-up calls to parents as reminders and provided crayons to ensure the children were equipped and encouraged to use the books.

Lastly, we needed to find the best way to provide the children with the books. Community partners, such as PHRII and the CHWs, had already built strong relationships and rapport with various communities in Mysore, which is vital to conducting service-learning projects and engaging the community (Rinaldo et al., 2015). The communities' trust in the organization and the CHWs facilitated the process of consulting with teachers, obtaining feedback from children, and identifying children of the appropriate age group. Since the books were relatively small and easy to transport, CHW and community-based organizations could distribute them at no cost to the children or their families. With almost 200 children from underresourced low-literacy urban communities being able to access information from these books and complete the surveys, this model was effective even when there were obstacles.

One limitation of our model was that we underestimated how much the children knew about COVID-19; we did not know the exact extent of the knowledge gap about the disease. Due to time constraints and the urgency of the pandemic, we could not fully determine how intellectually challenging the material should be. This uncertainty could have led to differences in the degree to which correct response rates improved across questions, with 2.5% being the lowest percentage improvement and 33.6% being the greatest percentage improvement. The question that had an increased correct response rate of 2.5% was answered correctly by 97.5% of the children ages 11–14 even before reading the books. However, some questions among the younger age group did have a significant increase, which suggests that

the books can still be used effectively to educate low-literacy populations. In future programs, we would consider ways of better assessing existing knowledge gaps before developing the material so it could more effectively cater to the population. Among the older age group, we would like to know if coloring, comic, and activity books would be as effective as they were among the younger group if the material was more challenging. On the other hand, the correct response rates for questions that the fewest children answered correctly at the pre-survey stage significantly increased at the post-survey stage, indicating that this program could effectively convey information and target knowledge gaps.

In conducting the program, we identified several best practices that could be useful for educational outreach programs among low-literacy populations. Actively engaging and building rapport with the community from the planning stage is key to successfully implementing a community-based program. We incorporated all five levels of community engagement according to the International Association for Public Participation (2017). We informed teachers, CHWs, and families of the concerns we had regarding limited access to education for children from underresourced urban areas. Then we consulted with teachers and received feedback on the most effective way to educate youth from this community.

Furthermore, we collaborated with PHRII and CHW to involve the community in this education program to see how impactful the books could be. Lastly, we empowered the community by taking even more feedback from the entire community, including children, to further improve the program. By addressing all levels of engagement and thereby gaining the community's trust, our educational program was made more successful. Especially when working with children, building trust is essential for reducing anxiety and increasing participation. Additionally, since every community is unique in its characteristics, resources, strengths, and barriers, the program should be catered to the community. For this reason, taking time to comprehensively understand the community's needs, assess the educational material with test groups, and incorporate community feedback is important. On the other hand, making the material slightly more challenging would improve effectiveness, as it will build resilience, make the experience more memorable, and increase the stimulation of learning.

Even though no data was collected on how the program impacted the community and community members' learning about COVID-19, our discussions with residents offered evidence of improvement in the community's awareness of the current problems. Since parents were encouraged to get involved with their children in learning about COVID-19, the children felt supported in learning about a topic they were unfamiliar with. The families' involvement in their children's education motivated them to finish the books. The program also inspired the parents and equipped them to do this again. This occurrence aligns with Smith's (2006) findings of parents in low-income families having less involvement in their children's education.

Furthermore, since this program was a joint activity between the children and their parents, both generations were motivated to improve their health literacy and knowledge. Families from underresourced urban communities tend to have low levels of health literacy, and there is an interest in implementing programs to improve it (Garner, 2020). Even though the books were meant for the children, the program's design allowed adults to increase their knowledge about COVID-19 as well.

Conclusion

Our study has found a low-cost model for distributing information to youth in an engaging and impactful manner. By involving the community and its different subgroups, we built mutual trust and designed effective strategies to aid program participation. Community partners and nonprofits should use this program to promote health education and literacy among kids and families about diseases such as COVID-19. This partnership between the community and organizations should be integrated into their outreach programs, as it can ensure the dissemination of information to underresourced urban communities when communities are going through a lockdown or have barriers to education. Even though limitations exist and further research on the topic is needed, the program can still be successfully adapted to low-literacy populations. Initially, this model was meant as a temporary substitute for health education via formal schooling for students who did not have the resources to access health information. Still, it can be used as a vehicle for distributing educational material to school-going children worldwide.

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