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Original Article

Integrating youth participatory action research and health communication to inform youth and young adult covid-19 vaccine communication research

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Abstract

COVID-19 vaccination rates remain lower among adolescents compared with adults. Youth participatory action research (YPAR) offers opportunities to inform youth vaccine communication at the local and population level. However, few studies have integrated systematic health communication research with YPAR. In the current study, a diverse team of paid high school interns, undergraduate student mentors and communication researchers in West Philadelphia YPAR programs developed a theory-informed communication survey to measure teen COVID-19 vaccine beliefs, information sources and behavior. The survey was distributed locally and informed youth-created vaccine campaign messages. In addition, YPAR-derived survey measures complimented a qualitative online elicitation survey with US young adults. Responses were coded using inductive content analysis, informing measures for a subsequent population-level study of young adults. This research followed protocols approved by an Institutional Review Board. Applying a YPAR framework elevated youth voices in the study development process. Communication theory and methods aided the development of survey studies to advance both local YPAR program objectives and population-level research. Future implications are discussed.

COVID-19 vaccination rates remain lower among adolescents compared with adults in the United States [1]. Identifying beliefs and information sources that influence youth vaccination decisions can inform ongoing vaccine communication for this population. Yet, few prior studies have engaged youth as co-investigators in identifying predictors of vaccination among their peers. The present study engages 'youth', teens in middle adolescence (i.e. about 15–19 years) and 'young adults', individuals in late adolescents (20–22 years) [2], in identifying effective communication approaches for these age groups.

Youth participatory action research (YPAR) is a framework in which youth and young adults partner in the development and execution of research to address issues affecting their lives [3–6]. In the current study, YPAR program participants engaged in local vaccine survey research and message design. Survey measures derived from YPAR programs were integrated with elicitation research to build a survey measuring young adult COVID-19 vaccination predictors. In the next section, we review prior studies on youth COVID-19 vaccination communication and describe how the current YPAR-informed study advances the literature.

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Literature review

Predictors of youth COVID-19 vaccination

Previous research has identified a range of COVID-19 vaccination predictors relevant to youth. For example, vaccine acceptance has been associated with confidence in vaccine safety and efficacy [7], desire to protect others and return to normal activities [8, 9], perceptions of vaccination to be common in one's social circle [10] and COVID-19 news exposure [11]. Vaccine hesitancy has been associated with mistrust in the healthcare system [9], concern about side effects [12], beliefs that the vaccine is unnecessary [10] or ineffective [8] and lack of information [9]. These studies suggest certain individual beliefs about vaccination, as well as interpersonal and media influences, may be important factors influencing youth vaccine decisions. However, few single studies have included comprehensive measures of a broad range of beliefs and sources relevant to youth vaccination. Understanding the beliefs that specifically affect youth vaccine decisions and the information sources that youth trust for vaccine information can inform targeted vaccine communication interventions. Through YPAR, youth can offer valuable contributions to this research.

YPAR

YPAR is an approach to research in which youth are active partners in developing studies and interventions to address issues affecting their lives [4]. The goal of YPAR is not to replace conventional research methods, but to embed them within a framework that reduces inequalities between the researcher and youth in order to allow for authentic communication. YPAR is rooted in Paulo Freire's liberationist view of education in which the teacher (or researcher) and pupil (or participant) exchange knowledge through a democratic process of dialogue [13, 14]. Drawing from Freire's emphasis on democratic dialogue, YPAR centers the importance of bi-directional communication between youth and adult researchers [13].

A core assumption of YPAR is that youth offer valuable expertise on the needs and solutions in their communities and that the quality and impact of research is enhanced when youth are engaged in, and not only the subjects of, the research process [15, 16]. In YPAR programs, youth co-define research questions and collect and interpret data [4, 17]. The YPAR framework assumes that, through active involvement in each phase of research, youth participation can inform the development of research that is relevant to youth needs and interests; tailored study measures and recruitment approaches; interpretation of study results that integrates youth perspectives; and sharing of intervention materials through youth networks [5]. While the extent to which participants should engage in the research process varies by program, YPAR should, at minimum, benefit youth partners, elevate their voices in the research process and integrate their contributions with the expertise of adult researchers [18].

In addition to prioritizing 'youth participation', the YPAR framework emphasizes 'action'. Informed by a transformative worldview, YPAR involves the application of research to real-world change meant to positively impact participants and their communities [19, 20]. Prior YPAR programs have addressed a variety of issues, including racial injustice, health, education, violence and safety [4, 21]. Within these domains, youth-engaged research has informed various forms of action, including building awareness, promoting policy change and community organizing [4, 14, 22]. One form of action often included in YPAR programs is the dissemination of knowledge through youth-created media [20]. Opportunities for creative expression and message creation have been recognized as not only important for communicating research findings, but also avenues for YPAR participants to process, learn and share [20].

Through the elevation of youth voices in research and development of youth-created materials to advocate for broader impact, YPAR programs have the potential to offer several advantages for youth who participate. Positive outcomes may include increased feelings of agency, knowledge, social competency and critical consciousness [4], as well as socio-cognitive development and sense of community belonging [22]. Middle adolescent youth (15–19 years old) may be particularly likely to benefit from and contribute to meaningful, challenging and relationship-oriented participation in research [2]. Recruiting youth in this age group for conventional survey studies involves several challenges compared with younger and older adolescents, due to declined engagement in school settings, developmental needs and age-related restrictions around data collection [2]. YPAR conducted in high schools can offer opportunities to engage middle adolescents who may not otherwise be captured in survey research and tailor research activities to their interests and needs. Thus, while maximizing benefits for youth participants is an intrinsically valuable priority of YPAR, doing so can also strengthen knowledge gained in the research process.

Opportunities of YPAR for youth COVID-19 vaccine research

From the perspective of researchers seeking to understand barriers and facilitators to adolescent vaccination, engaging in consistent dialogue with YPAR participants can provide a more comprehensive picture of the community assets and barriers affecting youth vaccine

decisions. Youth input can contribute to the development of research questions that directly meet youth concerns; youth-friendly vaccine survey recruitment materials, data collection instruments and protocols; appropriate interpretation of study results; dissemination of vaccine information through peer networks; and immediate application of research recommendations [5]. Thus, in addition to benefiting participants, YPAR may offer important advantages for addressing vaccine communication needs in broader youth communities. However, youth involvement in study development has been relatively limited across the COVID-19 vaccine communication literature.

The present study

The present study documents the process through which YPAR programs informed both local and population-level COVID-19 vaccine communication research. This study builds on the literature by offering a model for comprehensive survey measure development that draws on both conventional and participatory action processes, elevates diverse youth voices and offers immediate benefits to communities participating in research while also addressing health communication questions more broadly. The broader sequence of YPAR programs and stakeholder feedback that informed the current research model is described elsewhere [23]. Here, we highlight a subset of YPAR programs that focused exclusively on COVID-19 vaccination communication.

YPAR involves an 'iterative cycle of inquiry' through which youth participation continuously informs research directions [17]. As illustrated in Fig. 1, we propose a cyclical model in which (i) 'health communication research theory and methods' are integrated into YPAR programs to inform community-level action and (ii) 'youth participation', facilitated by the YPAR process, is integrated into the development of research that contributes to the health communication research literature. Reflecting this iterative process, the current paper deviates from a standard scientific paper format and is instead organized by two research objectives.

The first objective of this study focuses on the left (YPAR side) in Fig. 1 Integrating established communication research theory and methods, as well as youth participation, the first phase of research sought to inform community-level action. As part of a larger YPAR program, high school student youth interns and undergraduate young adult mentors co-developed a survey study examining beliefs and trusted sources relevant to COVID-19 vaccination among their peers. The integration of theory-informed practices helps to identify promising message strategies for a local high school vaccine campaign.

The second objective relates to the right (health communication research side) in Fig. 1. Drawing from YPAR youth participant contributions, the second phase of research sought to develop comprehensive measures of COVID-19 vaccine beliefs and information sources among US young adults broadly. Survey measures derived from YPAR programs were integrated with those derived from an online elicitation study of young adults. While not included in the current paper, this formative work informed a larger population-level study to advance communication theory and practice relevant to youth vaccine communication, which can eventually help guide YPAR programs in developing effective interventions locally.

Thus, the current model of research leveraged a reciprocal relationship between YPAR and communication science—participants in a YPAR-informed program drew from communication knowledge to inform local media messages for peers and 'contributed' to population-level research to build communication knowledge. Table I provides summaries of the format, program participants, research activities and products for each research phase described below. All research activities were approved by the Institutional Review Board of the University of Pennsylvania.

Objective 1: identifying promising COVID-19 vaccine messages for local youth

YPAR program

Overview

The Netter Center for Community Partnerships at the University of Pennsylvania was founded in 1992 to advance civic and community engagement in Philadelphia. The Netter Center facilitates sustained partnerships between community organizations, local public schools and the university and offers enrichment and academic programs for students of all levels. High schools that partner with Netter Center programs serve students who are over 90% Black and 99% economically disadvantaged [24], members of communities who have been disproportionately affected by COVID-19 [25]. Netter Center staff members are trained to work with adolescents and serve as liaisons between youth in the community and university students and faculty. Between February 2021 and August 2022, The Netter Center sponsored a series of YPAR-informed high school student research and media internships and a parallel undergraduate health communication seminar. These programs focused on applying communication research to addressing community-identified youth health needs throughout the COVID-19 pandemic.

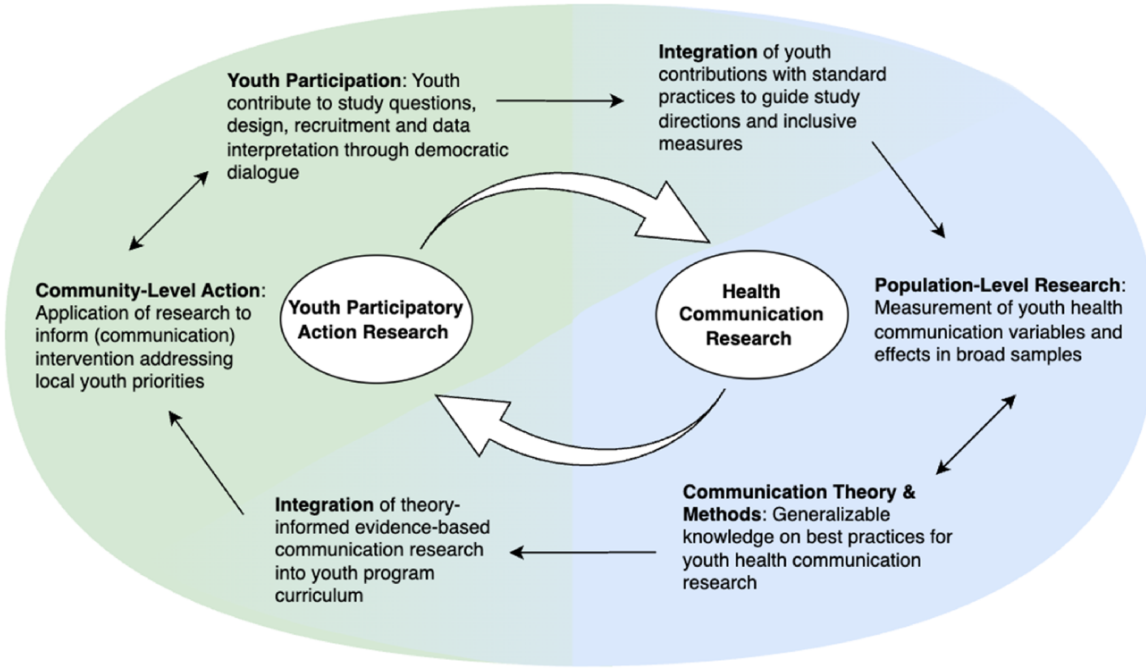

Fig. 1. Integrating YPAR and health communication research. Note. The solid green area (left) shows conventional practices in YPAR, in which youth participation in research informs community-level action and the focus on action invites youth participation. The solid blue area (right) shows conventional health communication research, in which population-level studies draw from and inform theory and practice. The current study contributes two critical intersection points; communication research was embedded into a YPAR program to complement youth participation in developing community-level action (a local youth-focused vaccine communication campaign) and youth participation was embedded into the development of a population-level study to ultimately inform (youth vaccine) communication theory and practice.

Table I. Formative research program summaries

Semester	Fall 2021	Spring 2022	Fall 2022
Format	Virtual YPAR program	In-person YPAR program + Undergraduate course	Online elicitation survey
Program participants	• Five youth interns • One Netter Center staff member • One researcher	• Four youth interns • Three undergraduate mentors • One Netter Center staff member • One researcher/instructor	• Two undergraduate mentors • One researcher
Research activities	Designed & administered local cross-sectional survey to Philadelphia high school students between September 24 and October 3 , 2021	Designed data-informed vaccine campaign messages for local high school students; revised Fall 2021 survey instrument	Administered qualitative elicitation survey to a national sample of young adults (18–22 years) through Prolific online panel between September 22–23, 2022
Product(s)	Data showing promising beliefs and trusted sources of COVID-19 vaccine information among Philadelphia high school students; survey instrument	Messages targeting promising beliefs and leveraging trusted sources; updated survey instrument	Data showing relevant beliefs and sources of vaccination information among US young adults; updated survey instrument

Fall 2021: virtual YPAR program and survey study

Structure of youth participation

In September 2021, Netter Center staff members, public school administrators and physicians in Philadelphia developed a program to address COVID-19 inequalities in the city by increasing vaccine availability in under-resourced neighborhoods. The Netter Center collaborated with the Children's Hospital of Pennsylvania and partner high schools to host a series of school-based

vaccination clinics in West Philadelphia. The program recognized a need to include youth voices in examining barriers and facilitators to vaccination and in spreading awareness about vaccine clinics to peers. A Netter Center staff member recruited five high school students who were enthusiastic to address vaccination needs in their community. Two vaccine champions were recommended by school staff and three were recruited through school vaccine clinics.

The program met for 90-minute Zoom sessions six times over 8 weeks (September–October 2021). Sessions opened with 20–30 minutes of conversation about youth lives, stressors and interests. Most discussions and activities centered around topics raised by youth, including mental health, social media and structural racism. For example, in one activity, youth participants drew maps of imaginary worlds that offered optimal support for mental health and wellbeing and discussed specific structural changes that would support youth health in their communities. In another activity, youth sorted printed Instagram posts about mental health based on trustworthiness and explained the elements of the post that made it more or less trustworthy. In a third, youth took part in improv skits. These explorations elevated youth voices in the program space, offered opportunities for youth to share and process their experiences and creatively brainstorm and built a sense of community in the program. This YPAR-oriented space facilitated comfort and in-depth discussions about vaccination and informed measures for a survey study.

Local survey study: integrating health communication theory and methods into YPAR

The YPAR research team developed a survey study to identify trusted sources of COVID-19 vaccine information among high school students, as well as behavioral beliefs inhibiting or driving vaccination decisions, to inform youth-created campaign messages promoting vaccine clinics. The survey development process was informed by the reasoned action approach (RAA), a theoretical model of behavior change used to develop many communication research studies and campaigns [26]. The RAA posits three types of cognitions may predict intention to engage in a given behavior: attitudes, perceived norms and self-efficacy [26]. According to the RAA, attitudes are informed by behavioral beliefs, which pertain to the outcomes one expects to experience as a result of engaging in the behavior. Perceived norms are informed by normative beliefs, which pertain to the extent to which one expects the behavior to be common (descriptive normative beliefs) and accepted (injunctive normative beliefs) by relevant individuals or groups. Finally, self-efficacy is informed by control beliefs or assessments of barriers to performing the behavior and confidence in overcoming these barriers [26]. Within these three broad constructs, specific beliefs (i.e. relevant anticipated outcomes, normative sources, barriers and facilitators) vary across behaviors and populations [27–29]. In prior work, elicitation surveys or focus groups with subsets of a target population have helped determine potentially relevant beliefs for a given context. These beliefs and their relationship with the target behavior are then assessed in a quantitative survey with a larger sample [30–33].

In the YPAR programs, adult researchers applied the RAA framework to facilitate structured focus group style discussions with youth interns. Youth interns, who, as high school students, had proximity to the target population, brainstormed a list of potentially relevant peer vaccine beliefs. Specifically, drawing from the RAA, youth considered, from the perspective of peers, what good and bad outcomes might result from getting vaccinated (behavioral beliefs), who might approve or disapprove (normative sources) and what factors might make vaccination more difficult or easier (control beliefs) [26]. The staff member took notes on a document that was screen-shared with interns. After an initial brainstorming session, youth observed and noted perceptions they encountered in conversations with peers over the next week. When the team met again, additional responses were added under each question.

Adult participants programmed a survey in Qualtrics, which included vaccine belief items generated through conversations with youth interns, as well as measures of vaccination status and intention. In total, 10 belief measures were generated pertaining to behavioral outcomes (vaccine safety and efficacy), 2 pertaining to descriptive norms (the commonness of getting vaccinated among peers and community members) and 2 pertaining to injunctive norms (peer approval of vaccination). Respondents were asked to indicate their level of agreement with each belief item (1 = Strongly disagree; 4 = Strongly agree). Negative outcome beliefs were reverse coded (so 1 = Most anti-vaccine; 4 = Most pro-vaccine). The survey also measured trust and distrust in parents/guardians, doctors, grandparents, siblings, friends, teachers, counselors, coaches and religious/spiritual leaders as sources of COVID-19 information (1 = Strongly distrust; 4 = Strongly trust). Youth interns reviewed all survey questions and provided feedback to inform the final version.

Local survey study recruitment

The research team collectively agreed disseminating the survey through the high school principal would be an effective recruitment approach. Youth participants presented the project to the principal, who shared the link with teachers. Teachers distributed the survey

to their students during homeroom between September 24 and October 3, 2021. In total, 125 high school students (about 42% of the student body) took part in the survey (with 75% completing the entire survey).

Local survey study analysis

Adult participants cleaned and analyzed data in Stata 15.0. Trust in each source of information was tabulated. The Hornik & Woolf (1999) method was used to identify promising campaign beliefs. The Hornik & Woolf method is a validated approach for guiding campaign message development, and takes into account the extent to which each belief is associated with a target behavior and is not already held widely in the study population (i.e. the 'percentage to gain') [28, 34]. The method assumes that campaign messages that increase the proportion of the population who hold certain beliefs will increase the proportion of the population who engage in the target behavior. In addition to using the Hornik & Woolf method to identify such promising beliefs, adult participants also calculated the mean trust scores for all information sources to determine which might be most persuasive messengers in a campaign.

Local survey study results

Respondent demographic data for the Fall 2021 local survey are included in Table II. The mean respondent age was 16 years old. Respondents were 81% Black (4.6% white, 2.7% did now know their race/ethnicity, 4.6% Hispanic/Latinx, 1.8% Asian/Middle Eastern, 3.7% Indigenous). Just over half of respondents identified as women (52.6%) while 2.2% identified as non-binary.

Trust in each source of COVID-19 information is included in Table III. Adults were more strongly trusted than peers for COVID-19 vaccination information. Specifically, 51% of respondents strongly trusted parents/guardians, 42% strongly trusted doctors and 39% strongly trusted grandparents. Only 18% of respondents strongly trusted friends.

Hornik & Woolf results are included in Table IV. All behavioral beliefs and descriptive norms measured in the survey were associated with vaccination behavior and had high percentages to gain. The most promising were the belief that getting the vaccine is safe, protects elderly loved ones, and descriptive norms (perceiving vaccination to be common among peers and in the community). The least promising belief pertained to injunctive peer norms ('peers will think it's weird'). This was the only belief measured that was not significantly associated with vaccination behavior. Results were presented to and discussed with youth interns.

Table II. Descriptive data for local YPAR survey

Category	Variable	Freq.	*N*	Perc.
Race/Ethnicity	Black/African American	88	109	80.7%
	Hispanic/Latinx	5	109	4.6%
	White (non-Hispanic)	5	109	4.6%
	Indigenous/American Indian	4	109	3.7%
	Asian/Middle Eastern	2	109	1.8%
	Other/Don't know	3	109	2.7%
Age (years)	13–14	25	94	26.6%
	15–16	54	94	57.4%
	17–18	15	94	16.0%
Gender ID	Woman	50	95	52.6%
	Man	43	95	45.3%
	Non-binary/Other	2	95	2.2%
Vaccinated*	Yes	65	122	53.3%
	No	47	122	46.7%

*Respondents were considered vaccinated if they had received at least one dose of a COVID-19 vaccine.

Spring 2022: in-person YPAR program with undergraduate course

Structure of youth participation

In January 2022, four youth interns (ages 17–18 years) were recruited through partnership schools to a 10-week internship program focused on conducting communication research and designing data-informed vaccination campaign messages. The program was connected with an undergraduate seminar. Undergraduate course materials focused on learning and applying health campaign research theory and methods, as well as the tenets of YPAR. As part of course work, three undergraduate students (young adults, ages 19–22) met with youth interns and one adult staff member on Penn's campus each week between February 1 and April 28. Undergraduate mentors re-analyzed the data as part of their course work and shared findings with youth interns.

Applying research findings to community-level action

Based on promising beliefs identified, youth interns and undergraduate mentors developed messages emphasizing vaccination safety, efficacy and community vaccine uptake rates. Given peers were not highly trusted sources of vaccine information in the Fall 2021 survey, youth interns designed messages featuring older adults and physicians as spokespeople. Youth interns chose to create a variety of message types, including a TikTok video, a cartoon-style zine and photographed portraits. Figure 2 illustrates excerpts from one vaccine message concept. Messages were distributed through afterschool programs and peer networks.

Table III. Trust in information sources of COVID-19 vaccination for local YPAR survey respondents

Source	*N*	Strongly trust	Strongly distrust	M (1–4)	SD
Parent/guardian	106	54 (50.9%)	8 (7.55%)	3.31	0.88
Doctor	108	45 (41.7%)	10 (9.3%)	3.18	0.91
Grandparent	100	39 (39.0%)	6 (6.0%)	3.17	0.84
Coach	97	22 (22.7%)	1 (1.03%)	3.04	0.66
Teacher	107	21 (19.6%)	1 (0.93%)	3.04	0.61
Siblings	98	30 (30.6%)	4 (4.1%)	3.00	0.84
School counselor	102	19 (17.7%)	3 (2.94%)	2.99	0.65
Friends	98	18 (18.4%)	4 (4.1%)	2.83	0.77
Religious leader	86	9 (10.5%)	9 (10.5%)	2.60	0.82

Table IV. Local YPAR survey Hornik & Woolf analysis results

Construct	Belief	Perc. to gain
Behavioral beliefs (negative consequences)	The COVID-19 vaccine is safe.	43%
	…I would have bad side effects*	14%
Descriptive norms	It is common for people my age to receive the COVID-19 vaccine.	39%
	It is common for people in my community to receive the COVID-19 vaccine.	34%
Behavioral beliefs (protect others)	..I would be protecting my older loved ones, such as grandparents if I received the COVID-19 vaccine.	36%
	…It would help me protect my community.	26%
Behavioral beliefs (protect self)	..It would be a waste of time*	33%
	The COVID-19 vaccine is effective.	26%
	…I would be protected against catching COVID-19.	18%
Injunctive norms	…My peers would be proud of me for doing so.	27%
	…I would be self-conscious about doing so*	26%
	…My peers would think its weird*	7.0%

N = 100.
Note. Percentage to gain calculated as the difference between the percentage of the broader sample who were vaccinated (53%) and the percentage of those who held each belief who were vaccinated. All items beginning with ellipses follow the stem, 'If I were to receive a COVID-19 vaccine in the next two months…'.
*Reverse coded.

Fig. 2. Example campaign message from Spring 2022 YPAR vaccine program. Note. Excerpts from zine developed by youth intern highlighting vaccine safety, featuring a Black physician as the main character.

Youth participation in revising local survey instrument

In addition to designing messages, the Spring 2022 YPAR team updated the Fall 2021 survey instrument to include more comprehensive and timely measures. Undergraduate mentors led discussions guided by the same RAA-informed questions used in the Fall 2021 program (pertaining to the potential advantages, disadvantages, barriers, facilitators and normative influences affecting peer COVID-19 vaccination). Conversations focused specifically on potential side effect

concerns, misinformation beliefs and roots of mistrust. Sources beyond interpersonal networks, including media platforms and government agencies, were discussed.

When reflecting on vaccination in their communities, interns shared that some friends and relatives did not trust vaccines due to experiences with racial discrimination in the medical system. Interns also shared specific concerns their peers held pertaining to side effects, including feeling low energy as a short-term side effect, getting sicker from the vaccine than from COVID-19 and missing out on activities due to side effects. Some interns also reported having encountered false rumors from peers or online, such as the idea that the vaccine contains COVID-19 or alters DNA. Finally, interns mentioned potential uncertainty about long-term side effects and low access to trustworthy information about the vaccine.

From these structured discussions, the Fall 2021 survey instrument was updated. Belief and norm batteries were expanded to include more specific measures. The trust battery was also updated to include the platforms and agencies interns mentioned as vaccine-specific information sources. The YPAR-informed survey became a starting point for a population-level study examining communication-relevant predictors of youth COVID-19 booster vaccination.

Objective 2: developing comprehensive measures of COVID-19 vaccine predictors among US youth and young adults

While the first phase of research focused on applying YPAR-informed research to local youth vaccine communication, discussions within the program offered critical insight for vaccine communication more generally. Following local vaccine campaign research, and based on conversations in YPAR programs, a study was developed to examine COVID-19 booster uptake predictors (beliefs and information sources) in US young adults more broadly. Due to space considerations, full details of the final quantitative longitudinal survey are included elsewhere (Kikut-Stein, in preparation). Below, we focus on the process of survey measure development. The objective of this process was to draw from the contributions of elicitation and YPAR research to comprehensive scales measuring youth-specific behavioral beliefs and trusted information sources.

Developing belief and source measures

Fall 2022 elicitation survey: standard formative research practice

Prior formative health campaign research has included qualitative elicitation studies to capture context-specific behavioral beliefs, norm beliefs and control beliefs [26, 27, 32]. Applying this standard method as a complement to YPAR research, an online elicitation study was administered to inform quantitative survey measures of vaccine beliefs and information sources. The elicitation questionnaire followed a similar structure to other RAA-guided elicitation questionnaires [26] and YPAR survey development discussions, including open-ended questions about the benefits, disadvantages, barriers and facilitators to receiving a booster dose. Each question included space for up to five short written responses.

Respondents were eligible for the elicitation study if they were 18–22 years old, US residents and had received an initial COVID-19 vaccination. The sample was recruited through the Prolific platform on September 22–23, 2022. In total, 38 eligible respondents completed the survey (45 started, 42 qualified, 38 completed). This sample size met conventional standards of elicitation research [26]. Full demographic data on the elicitation sample are included in Table V. Qualitative thematic analysis was used to code elicitation survey responses. Coding was validated by two young adult coders who were undergraduate mentors in YPAR programs. The goal of the coding process was to ensure the final survey was comprehensive and captured all types of vaccine beliefs and sources mentioned in both YPAR discussions and the elicitation study.

Table V. Demographic data for Fall 2022 elicitation survey

Category	Variable	Freq.	Perc.
Race/Ethnicity	Black/African American	3	7.9%
	Hispanic/Latinx	9	23.7%
	White (non-Hispanic)	28	73.7%
	Indigenous/American Indian*	1	2.6%
	Asian/Middle Eastern	8	21.1%
	Other/Don't know	0	0.0%
Age (years)	17–18	2	5.3%
	19–20	12	31.6%
	21–22	24	63.2%
Gender ID	Woman	16	42.1%
	Man	18	47.4%
	Non-binary/Other	4	10.5%
Eligible for updated booster dose*	Yes	29	76.3%
	No	6	15.8%
	Don't know	3	7.9%

*$N = 38$. All respondents for the elicitation survey were fully vaccinated. Respondents were considered eligible for a new COVID-19 bivalent booster if their most recent vaccine dose was more than 3 months prior to data collection.

Integrating YPAR youth contributions with standard elicitation survey findings to develop survey measures

Behavioral belief measures

To develop behavioral belief measures, YPAR measures and elicitation responses pertaining to vaccination outcomes were organized based on emergent themes. This initial round of iterative coding yielded four broad types of potential vaccination outcome beliefs. These included: direct positive outcomes (protection resulting from getting the booster), indirect positive outcomes (benefits expected as a result of better protection), direct negative outcomes (side effects resulting from the booster) and indirect negative outcomes (disadvantages expected as a result of booster side effects). Within each outcome type, additional sub-categories were identified. Positive direct outcomes included: protection for self against COVID-19, protection for self against serious symptoms of COVID-19 and protection for others against COVID-19. Negative direct outcomes included long-term and short-term side effects. Indirect outcomes included emotions resulting from anticipated added protection (positive) or anticipated side effects (negative) and increased ability to participate in activities due to added protection (positive) or decreased ability to participate in activities due to side effects (negative). Belief in indirect outcomes was excluded from the final survey to avoid redundancies (believing in a direct outcome would be necessary in order to believe in an indirect outcome).

To ensure the final survey instrument comprehensively captured elicitation responses, the two coders categorized all elicitation responses into one of the nine categories described above. All items in the elicitation survey aligned with outcome types captured in the YPAR instrument. Twelve specific items remained in the survey instrument that emerged in both the YPAR program and the elicitation survey. Six additional items were added as a result of elicitation response coding. Table VI shows coding definitions, original YPAR measures from fall 2021 and spring 2022, example elicitation responses and final belief measurement items.

Information source measures

Elicitation respondents were asked to list up to five sources of information about COVID-19 vaccine boosters (individuals, organizations or media sources). Through an initial round of coding, 13 source themes were identified. Coders verified all responses fit into one of these 13 themes.

Eight categories of sources were previously identified in YPAR discussions, including public health officials and agencies, school, doctors/nurses/clinicians, friends and family, mainstream news media, liberal news, conservative news and social media. Four categories arose from elicitation responses and were added to the survey instrument: companies, scientific experts, pharmacies and workplace. Finally, sources defined based on their knowledge of or beliefs about vaccines (e.g. 'informed people', 'anti-vaxxers', 'conspiracy theorists') were excluded from the instrument, as these were subjective perceptions and trust in such sources would likely conflate with an individual's position on vaccines. Table VII shows original YPAR measures, example elicitation responses within each category and final survey measures.

Discussion

The current study integrates YPAR with health communication research to develop local COVID-19 vaccine campaign messages and survey measures of COVID-19 vaccination predictors among US adolescents more broadly. This study not only identifies beliefs and information sources potentially influencing youth vaccine decisions but also engages youth as co-investigators in the research process (and co-authors on the current paper). By combining conventional health communication research methodologies with participatory action processes, this study advances the literature on youth and young adult vaccination communication needs.

Youth COVID-19 vaccination predictors

Consistent with previous research, the findings of this study underscore the multifaceted nature of COVID-19 vaccine decision-making among adolescents. In a local survey of high school students, beliefs about vaccine safety and efficacy, desire to protect oneself and others and perceptions of vaccination as common in one's social circles were associated with behavior and identified as promising targets for youth-created messages. Local survey measures were integrated with findings from a national online elicitation survey, together capturing 18 COVID-19 vaccine beliefs. These included additional beliefs about anticipated potential negative outcomes (i.e. side effects) and positive outcomes (i.e. protection for self and others). While similar beliefs can be found across other studies of adolescent vaccine acceptance [7, 9, 12, 35–37], no study has identified or measured all 18 beliefs and their effects on behavior. One potential use of this multi-item measure is to test which categories of belief (e.g. protecting others or short-term side effects concerns) influence continued vaccination most and, of those, which are most likely to change with public health messaging.

This study also identified 12 COVID-19 vaccine information sources relevant to youth and young adults. Previous literature highlights the potential importance of expert sources [35], parents [38] and

Table VI. Categorizing and tracing development of youth COVID-19 vaccine behavioral belief measures

Category	Sub-category	Coding definition	Local survey item	Example elicitation response	Final population survey item
Direct positive outcome: protection expected as a result of getting the booster	Protect self from catching COVID-19	Describes better protection from getting COVID as a result of getting the booster	• I will be better protected against catching COVID-19	• Greater protection against COVID-19 • Prolonged immunization • Protect against new variants as they arise	• I will be better protected against catching COVID-19 • It will prolong my protection against COVID-19 • It will increase my protection against novel variants of COVID-19
	Protect self from serious symptoms of COVID-19	Describes better protection from the symptoms of COVID as a result of getting the booster	• I will be better protected from getting seriously ill from COVID-19 • I will be less likely to need to be hospitalized if I get COVID-19	• Less likely to get very sick from COVID if infected • Won't be hospitalized for COVID • Faster healing if ill • Lesser risk of death as a complication of COVID-19 • Decrease in long COVID symptoms	• I will be better protected against serious illness if I get COVID-19 • I will be less likely to need to be hospitalized if I get COVID-19 • It will help speed up my recovery if I get COVID-19 • It will reduce my risk of death from COVID-19 • It will reduce my risk of experiencing long-COVID
	Protect others from COVID-19	Describes better protection for others as a result of one getting the booster	• It will protect others • It will protect older loved ones, such as grandparents • I would be doing my part to end the COVID-19 pandemic	• Lower chance of spreading COVID-19 to others • Help work toward herd immunity • Protect those who are at risk or immunocompromised • Keeping friends and family safer	• I will be less likely to give COVID-19 to others • It will protect my older loved ones, such as grandparents • It will help the population reach herd immunity • It will help protect people with weakened immune systems
Indirect positive outcome: good expected to occur because of protection afforded by the booster	Emotional benefit	Describes reduced anxiety or fear as a result of getting booster	Not mentioned	• Peace of mind • Feel safer going out places • I feel more comfortable knowing I have an extra level of protection	Excluded

(continued)

Table VI. (Continued)

Category	Sub-category	Coding definition	Local survey item	Example elicitation response	Final population survey item
	Increased participation	Describes ability to do something as a result of protection from the booster	• It would help me be able to participate in activities • It would allow me to keep doing in-person school	• Not needing to wear a mask • Go to a public event with a lot of people • Able to travel • Visit family	Excluded
Direct negative outcome: side effects expected to occur as a result of getting the booster	Long-term side effects	Describes risk of experiencing side effects lasting more than a few days after getting the booster	• The COVID-19 vaccine is safe • I would have bad side effects	• Do not know the long term side effects of the booster • Conspiracy theories concerning microchips • Immune system becomes over reliant on vaccine antibodies	• I will experience long-term side-effects from the booster, lasting longer than a few days after getting the booster • The booster will reduce my immunity to COVID-19 • I could die as a result of the booster
	Short-term side effects	Describes risk of experiencing side effects occurring within a few days after getting the booster	Not mentioned	• I might feel sick for a couple of days • Malaise/discomfort following vaccination • Potentially getting more sick than you were previously	• I will experience short-term side-effects from the booster, occurring within a few days of getting the booster • I will have low energy for a day or two after getting the booster • The booster will make me sicker than getting COVID-19
Indirect negative outcome: bad expected to occur because of booster side effects	Emotional consequence	Describes anxiety or fear around negative outcomes of getting the booster	• I would be self-conscious	• Emotional discomfort while receiving the vaccination • I don't like needles	Excluded
	Missing out	Describes inability, or potential inability, to do something as a result of booster side effects	• It would be a waste of time	• I might miss out on events due to being temporarily unwell • Might have to take time off work/school to recover from sickness	Excluded

Note. Final survey items followed the stem, 'If I get a COVID-19 booster in the next three months…' In the final population-level survey [23], respondents were asked to rate their agreement on a 5-point Likert scale (strongly agree to strongly disagree) with each statement pertaining to outcomes of receiving the new booster in the next three months. To measure behavioral beliefs as a single variable, a scale was generated averaging all behavioral belief responses.

Table VII. Categorizing and tracing development of youth COVID-19 vaccine information source measures

Category	Local survey measure	Example elicitation responses	Final population survey measure
Clinicians	• Doctors, nurses and other clinicians	Personal physician, family doctors	Your primary care doctor, nurse or clinician
Friends/Family	• Adults in my family (parents, grandparents and other relatives) • Peers (other high school students)	Family, siblings, parents, uncle, aunt Roommates, friends	Your friends and family
School	• Adults at my school (school counselors, teachers, coaches)	My university, college professors	Your school
Government & official health agencies	• National public health agencies (such as the U.S. Center for Disease Control and Prevention [CDC], Food and Drug administration [FDA]) • Philadelphia department of public health • The US government	WHO homepage, FDA, NHS, NCBI, CDC articles/updates State government websites, State health department, my state's governor Federal government websites and sources	Public health officials and agencies
Mainstream media	• The news (newspapers, news sites, television news, radio news)	News websites, New York Times, Washington Post, AP news, ABC, World news	Mainstream news media such as TV news, newspapers or radio news
Liberal media	• Progressive or liberal news media	MSNBC, CNN, Vice	Liberal or progressive news sources
Conservative media	• Conservative news media	Fox News, Conservative media, Joe Rogan podcast	Conservative news sources
Social media	• YouTube • Instagram • TikTok • Twitter • Reddit • Discord	YouTube, Instagram, TikTok, Twitter, Reddit, Rappler, Facebook	Accounts you follow on social media such as TikTok, Instagram, Facebook, YouTube or Twitter
Scientists	Not mentioned	Scientific journals, peer-reviewed articles, scientists	Scientific experts who study COVID-19 vaccines
Work	Not mentioned	My work, coworkers, workplace	Your workplace
Pharmacies	Not mentioned	CVS, Walgreens, Safeway, Target, Local ads put out by clinics/pharmacies	Pharmacies
Companies	Not mentioned	Pfizer TV ads	Companies which developed the COVID-19 boosters

Note. In the final population-level survey study [23] participants were asked a set of questions pertaining to the 12 potential sources of COVID-19 booster information identified in formative research in the final column. Questions measured exposure to each source, trust in each source, and perceived booster support of each source (valence). To measure exposure, participants were asked how often they had seen or heard information about COVID-19 boosters from each source in the past 2 months (the bivalent booster was approved 2 months before the first survey wave) (never or not applicable to very often). Next, participants were asked how much they trust or distrust each source (strongly distrust to strongly trust). Finally, to measure valence, participants were asked what they thought each source would recommend about them getting a booster in the next 3 months (time between T1 and T2) (strongly against to strongly in favor). For each source, a score ('EVT') was generated from the product of exposure to booster information from the source, trust in the source and perceived source support for boosters. An aggregate information influence score captured the average EVT across all source scores.

peers [10, 38, 39] for youth, as well as the role of religious faith in many Black communities [40, 41]. Community-based programs have leveraged peer influence in youth vaccine messages [42] as well as faith-based ambassadors as information channels for older Black adults [40]. In the local survey of mostly Black youth, physicians, scientists and older family members were more trusted sources of COVID-19 vaccine information than were peers and religious leaders. Similarly, a wide range of information sources—including pharmacies, media sources and employers—were mentioned by young adults in the elicitation survey. These findings suggest adolescents rely on a range of vaccine information sources, peer influence may be less relevant

for COVID-19 vaccine decisions than for other types of decisions and trusted sources of information may vary by community and age group. Future work should consider how factors like politicization of health recommendations and perceived risk may influence the sources on which youth and young adults rely for different health decisions.

YPAR framework and vaccine communication research

Relevant beliefs and information sources often differ across contexts and evolve over time. Thus, the more generalizable contribution of this study is a proposed model of responsive and participatory health communication research. Leveraging existing partnerships, established health communication research theory was applied to addressing local community needs and including diverse youth perspectives in generating new research. As shown in the left (solid green) area of Fig. 1, prior YPAR studies have included both 'youth participation' throughout the research process [43] and 'community-level action' in various forms [20]. As shown in the right (solid blue) area of Fig. 1, prior health communication studies have involved *population-level surveys* and the use of communication *theory and methods* [27, 44–47]. The critical contribution of the current study lies in the overlapping areas—the integration between YPAR and health communication. Health communication theories guided a community-level intervention in a YPAR program. Specifically, the RAA [26] and Hornik and Woolf Method [28] informed the development of targeted vaccination messages for a local vaccine campaign. Later, youth participation contributed to comprehensive measures of COVID-19 vaccine predictors among US young adults, allowing for the measurement of broader trends.

Strengths and limitations

This study offers several strengths, including the development of comprehensive measures and a model for integrating YPAR with health communication research to inform local interventions and future population-level research. By centering youth voices and experiences, YPAR programs facilitated a deeper understanding of adolescent perspectives, promoted trust and engagement among youth participants and allowed for ongoing dialogue and responsive research. However, this work is not without limitations. This study is descriptive, focusing on the process of measure development but does not test measure validity. The effects of belief and sources on behavior were examined in the subsequent longitudinal study, but outside the scope of this paper (Kikut-Stein, in preparation). The YPAR process was also lengthier, time-intensive and resource-consuming, yet yielded similar measures as the elicitation study. In total, 10 of 30 items (beliefs and sources) derived from elicitation research were not in the original YPAR instrument.

One explanation for this gap is the intention behind each data collection approach. The elicitation study included a national sample of respondents, who were asked to respond to questions with their personal beliefs. YPAR cohorts included small groups of mostly Black and vaccinated Philadelphia high school students. Rather than participate as study respondents, youth interns contributed and discussed potential measures relevant to peers based on community listening. The purpose of YPAR conversations was to include diverse perspectives in study development, and to address needs in local peer networks, rather than to gain a comprehensive list of items that would represent young adults more broadly. Youth interns helped capture perspectives that may have been missed with online elicitation research—which included a slightly older and mostly white national sample.

The age difference between YPAR participants and elicitation survey respondent ages may be viewed as a limitation of this study. However, others have recognized the need to include age-appropriate engagement approaches based on phase of adolescence [2]. While young adults (older adolescents) were included as either YPAR program mentors or elicitation study participants, the YPAR framework was primarily applied in reaching high school students (middle adolescents) [2]. This responded to a need to include the perspectives of youth, particularly in under-resourced communities, who are often excluded from conventional research studies due to declined attendance in school settings, structural barriers to health access and age-related restrictions around data collection [48, 49]. The extent to which communication needs and appropriate approaches to engagement vary by developmental stage is a ripe area for future research [2].

Implications

The current study has implications for adolescent COVID-19 vaccine communication and public health more broadly. First, we produce comprehensive measures of youth and young adult COVID-19 vaccine beliefs and information sources. These scales can allow future quantitative studies to test which categories of beliefs or trusted information sources are likely to predict vaccine uptake and are therefore promising campaign targets and channels. Second, findings suggest that adolescents rely on a range of information sources and that those trusted in other audiences and for other topics (e.g. peers) should not be taken for granted as influential for adolescent vaccination. In the current

study, older family members and experts were important sources of COVID-19 vaccination. Data should be collected for new contexts and the potential for youth to rely on different sources based on the nature of each behavior should be considered. Finally, diverse perspectives should and can be included in formative communication research through integration with YPAR programs. Opportunities for YPAR are made feasible at the institutional level. In the current study, partnerships between a university and local public schools and organizations were foundational. At the peak of the pandemic, longstanding relationships facilitated vaccine distribution and engaged youth in research through YPAR programs. Institutions and communication researchers should invest in community partnerships long before public health emergencies occur in order to facilitate youth participation in responsive interventions and to more effectively communicate with diverse audiences when new vaccines and other recommendations are introduced.

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Conflict of interest statement

None declared.

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