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"Cover your mouth and nose": communication about health protection behaviors by role models in YouTube COVID-19 videos for children

Jocelyn Steinke, Carolyn A. Lin, Tamia Duncan and Viviana Zambrano

Abstract

YouTube videos offer a potentially useful vehicle for the communication of science, health, and medical information about COVID-19 to children. Findings from this research showed that primary characters appearing in children's educational YouTube videos about COVID-19 were most often adults, with about an equal number of men and women and few characters from diverse racial and ethnic backgrounds. Primary characters frequently demonstrated and modeled protective health measures. Adult expert characters (medical professionals and scientists) appeared to some extent in these videos. Directive discourse frames appeared most frequently, followed by the informative and persuasive discourse frames when communicating scientific and health information. Changes in the use of informative, directive, and persuasive frames before and after the U.S. Centers for Disease Control (CDC) announced guidelines on how to communicate about COVID-19 with children are explored.

Keywords

Health communication; Representations of science and technology; Science and media

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The sudden outbreak and rapid rate of transmission of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) during its initial onset followed by a later surge in cases and hospitalization among children caused by the Delta SARS-CoV-2 variant in the U.S. [Siegel et al., 2021] created a critical need for effective health communication about coronavirus disease 2019 (COVID-19) for children. Early studies indicated that children infected with the virus often were asymptomatic [Miri et al., 2020], experienced milder symptoms than adults [Brodin, 2020; Ludvigsson, 2020; Oterino Serrano et al., 2020], and overall, the number of cases among children were less frequent than those among adults [Buonsenso et al., 2020; Zhu et al., 2021]. Subsequently, early concerns focused primarily on children's role in transmission of the virus to others. However, greater concern emerged with the marked rise in cases of the virus among children and adolescents from June to

August 2021 that led to more visits to hospital emergency departments and an increase in hospital admissions, especially in states with lower vaccination rates [Siegel et al., 2021]. During the early months of the appearance of the Delta variant, the number of COVID-19 cases among children and adolescents increased by almost five-fold in 14 different states in the U.S. [Delahoy et al., 2021]. Both early and later concerns about COVID-19 infection among children underscored a critical need for effective health messaging about COVID-19 in order to promote health protection behaviors and good hygiene practices among children.

In May 2020, a few months after official news reports of the outbreak of the pandemic in the U.S., the CDC posted recommendations for communicating about COVID-19 to children on their website [Centers for Disease Control and Prevention, 2020]. Communicating about science and health with children is especially difficult because of the complexity of this information. Science and health communication about COVID-19 to children presented an unusually unique challenge. In addition to the difficulties in communicating complex information to a young audience, typical communication channels were more scattered during the pandemic because of the sudden shift from in-person, classroom instruction to online, remote instruction [García and Weiss, 2020]. As schools closed, families sheltered-in-place, and children turned to online learning during the early months of the pandemic [Cluver et al., 2020; UNESCO, 2020], increased online activity led to unprecedented access to digital media for children [UNICEF, 2020].

Even prior to the COVID-19 outbreak, children's and adolescents' online media use and online presence had escalated from levels reported in previous years [Anderson and Jiang, 2018; Gelmez Burakgazi and Yildirim, 2014]. In recent years, YouTube has emerged as one of the most popular online platforms for children [Kang, Ha and Velasco, 2017; Neumann and Herodotou, 2020a; Neumann and Herodotou, 2020b; van Kessel, 2019]. During the pandemic, YouTube videos became readily available sources of scientific, health, and medical information about COVID-19 for children. The emergence of children's videos about COVID-19 provided an opportunity to investigate how scientific, health, and medical information about the virus was communicated to children through this popular digital media platform during a global pandemic. However, few prior studies have examined messaging approaches and design features found in children's YouTube videos or their potential effects on children [Jones and Cuthrell, 2011; Neumann and Herodotou, 2020a].

The present study addressed this research gap by taking an important first step in examining the content of children's YouTube videos about COVID-19 posted during the first eight months of the pandemic in the U.S. This study contributed to extant research in science and health communication in several important ways. First, drawing on social cognitive theory, this study examined the attributes of primary characters and the extent to which primary characters demonstrated and modeled recommended health protection behaviors. Second, this study investigated the presence and diverse representation of expert characters (doctors, nurses, public health officials, psychiatrists, scientists) in these videos. Third, this study examined the discourse frames used to communicate scientific and health information in these videos. Fourth, this study assessed changes in the use of discourse frames in children's videos posted before and after issuance of CDC guidelines for health communication about COVID-19 for children. The YouTube

children's videos analyzed for this study featured content that targeted children from preschool-age (4 and under) to early adolescence (9–12) as specified in YouTube content settings designations for children [YouTube, 2021].

Literature review

Observational learning from media role models

Social cognitive theory describes, predicts, and explains how children learn to imitate behavior modeled by others through "observational learning" [Bandura, 2001, p. 270] and "identificatory learning" [Bandura, 1963, p. 591; Bandura, 1969]. Research on social cognitive theory has highlighted the importance of media role models in influencing children's attitudes and behaviors [Bandura, 2002; Bandura, 2009; Bandura, Ross and Ross, 1963a; Bandura, Ross and Ross, 1963b]. According to this theory, "media both teach new forms of behavior and create motivators for action by altering people's value preferences, efficacy beliefs, outcome expectations, and perception of opportunity structures" [Bandura, 2001, p. 286]. Media characters, as vicarious role models, are important because they can influence children's attitudes and behaviors through both the information they convey and the behaviors they model [Bandura, 2001; Bandura, Ross and Ross, 1963b].

Learning from media role models may be even more pronounced when children identify with characters in the media content [Hoffner and Buchanan, 2005; Moyer-Gusé, 2008; Steinke et al., 2012]. Research specifically focused on observational learning and social modelling from health messages has found that observation of others demonstrating a desired behavior can indeed promote adoption of healthy behaviors. One study found that "[s]eeing other people engaged in a certain practice (e.g., eating fruit and vegetables) suggests that the practice is desirable, safe, and beneficial to one's well-being" [Samson, Nanne and Buijzen, 2021, p. 3]. Research also has found that same-gender, same-race, and same-ethnicity role models are especially important for promoting positive behavior among children and adolescents [Carsten Conner and Danielson, 2016; Villiers et al., 2015].

YouTube, children, and science communication

YouTube has become an easily accessible and popular online source of information for children [Jaakkola, 2020; Neumann and Herodotou, 2020b; Smith, Toor and van Kessel, 2018] and the preferred digital media platform for many young children [Marsh et al., 2015]. According to a recent report by the Pew Research Center, 81 percent of parents with children under 11 reported that they allowed their child to watch YouTube content, and 34 percent of parents indicated that their child watched YouTube content regularly [Smith, Toor and van Kessel, 2018]. Children as young as 12 to 17 months of age view YouTube videos [Hourcade et al., 2015]. Many of the multimedia content features of YouTube videos (e.g. audio, text, special effects, animated characters) have been found to attract children's attention [Neumann and Herodotou, 2020b]. However, research on children's learning from YouTube video content is limited. One study found that children ages 6 to 24 months imitated dance moves on YouTube videos, identified with cartoon and fairy-tale characters in the videos, and reported enjoying advertisements for familiar foods [Yadav et al., 2018]. However, this study found while children

identified with and imitated the behavior of YouTube characters, they did not learn much else from the videos [Yadav et al., 2018].

Science and health communication through digital media platforms, like YouTube, has become more common for communicating scientific and health information to non-expert audiences [Anderson, Brossard and Scheufele, 2010; Brossard and Scheufele, 2013; Hunter, 2020; Papadopoulos, 2018; Renee, 2018; Simis-Wilkinson et al., 2018]. Prior science communication research on YouTube has focused primarily on its use in enhancing science classroom instruction. One study found that YouTube music videos about the big bang theory, theory of evolution, the periodic table of the elements, and the human brain were effective in supporting science outreach efforts to promote positive images of science and foster science engagement for students as well as for introducing scientific ideas and concepts in educational settings [Allgaier, 2013]. YouTube videos also have been found effective for enhancing engagement and learning in undergraduate chemistry classes [Smith, 2014], and learning about science history and promoting participation in virtual field trips [Everhart, 2009]. These studies highlight the potential for effective science and health communication to children through YouTube videos.

Science communication for children

Little prior research has explored best practices for communicating scientific, health, and medical information to children through digital media. Prior research in this area has focused primarily on learning from viewing science television programs or behavioral changes from viewing public service announcements (PSAs) or television commercials promoting healthy behaviors. Specifically, prior *science communication* research has identified design features of television programs most likely to promote enjoyment and learning for children [Mares, Cantor and Steinbach, 1999]. Other research has established that specific genre and character attributes best promote identification with scientist characters on television programs watched by adolescents [Steinke et al., 2012]. Research also has found that anthropomorphic depictions — those featuring human characteristics to depict science concepts — promote children's learning from science television shows [Bonus and Mares, 2018].

Other studies have focused specifically on message design strategies that promote science understanding in formal and informal science educational environments. For example, one study found that elementary children's science learning from an educational science television program was enhanced when scientific content was presented "in the format of a pop-out from a feature story" and highlighted the scientific aspects of everyday events [Mares, Cantor and Steinbach, 1999]. Another study found that one half of children's television programs used refutation to teach science concepts and one-third of these programs conveyed science concepts using anthropomorphism, or giving animal characters human-like features and traits [Bonus and Mares, 2018, p. 451]. This study found that the use of refutation had no effect on pre-school age children's science learning; however, the use of anthropomorphism led to a positive increase in children's science knowledge. Although not specifically focused on science learning from media, another study noted that spacing out learning events over time rather than in rapid succession

can facilitate the acquisition of science concepts for early elementary school children [Vlach and Sandhofer, 2012].

Prior *health communication* research has examined the use of message design and different types of appeals [Nicolini, Cassia and Bellotto, 2017] in public health campaigns and interventions to best promote healthy behavior for a variety of health issues such as nutrition [Nicolini, Cassia and Bellotto, 2017; Tan et al., 2018], teen smoking [Farrelly, Niederdeppe and Yarsevich, 2003; Rhodes, Ralston and Bigsby, 2016; Zhao and Cai, 2016], and alcohol consumption [Adnsager, Austin and Pinkleton, 2001; Pinkleton, Austin and Fujioka, 2001; Pinkleton, Austin and Van de Vord, 2010; Slater et al., 1996]. Research has examined the use of different types of appeals in health communication messages for children. For example, a study of 8- to 12-year-old children found that the use of threat appeals in audio-visual advertisements about unhealthy eating habits was more effective than usual appeals in promoting healthy eating behaviors, particularly if children were left alone to deal with post-exposure affective reactions [Charry and Demoulin, 2012]. This study also found that threat appeals most often elicited the emotions of sadness, worry, and disgust, rather than fear, following exposure [Charry and Demoulin, 2012]. By contrast, a study of 7- to 18-year-olds found that the use of social appeals, or images featuring large, gregarious groups of children and adolescents enjoying healthy foods, were more memorable, particularly for teenagers compared to children and preteens [Samson, Nanne and Buijzen, 2021]. Another study of adolescents reported that humor, fear, and nurturing appeals in PSAs were related to the intention to cut back on sugar-sweetened beverages with perceived argument strength of the health PSAs mediating direct effects of fear appeals and indirect effects of humor and nurturance appeals on intention to cut back on sugar-sweetened beverages [Bleakley et al., 2015].

One of the few studies focused on *medical communication* for children assessed the readability and use of visuals in medical research informational consent forms in the Netherlands [Grootens-Wiegers et al., 2015]. This study found low readability scores for consent forms and noted only three of the 22 forms used visuals [Grootens-Wiegers et al., 2015]. The researchers also noted that children preferred forms with visuals, especially realistic images and funny cartoons, as well as forms that included informative, clear text or captions [Grootens-Wiegers et al., 2015]. The researchers noted, "there is little research on the quality of medical information for children and adolescents, and there are no evidence-based insights in how health communication can be optimally adapted for this target group" [Grootens-Wiegers et al., 2015, p. 91].

Discourse frames

Few studies have considered the use of discourse frames in science and health communication for children. Discourse is the language by which information is communicated to others. Foucault [1972] described "manifest discourse" [p. 25] simply as information that was "already said", [p. 25] noting that "[d]iscourse must not be referred to the distant presence of the origin, but treated as and when it occurs" [p. 25]. Media discourse, described most often in the context of news discourse, has been described as "a set of interpretative packages that give meaning to an issue" [Gamson and Modigliani, 1989, p. 3]. Research has identified

framing devices in news media discourse (metaphors, exemplars, catchphrases, depictions, and visual images) that serve as communicative strategies [Gamson and Modigliani, 1989].

In communication research, frames have been used to describe selection of language by a source when encoding meaning in to media content. Frames have been described as "a central organizing idea for making sense of relevant events and suggesting what is at issue" [Gamson, 1989]. Framing highlights salience and importance, and "[t]o frame is to select some aspects of a perceived reality and make them more salient in a communicating text, in such a way as to promote a particular problem definition, causal interpretation, moral evaluation, and/or treatment recommendation for the item described" [Entman, 1993, p. 52]. Communication researchers have distinguished between — equivalence framing, "a form of framing that involves manipulating the presentation of logically equivalent information", [Cacciatore, Scheufele and Iyengar, 2016, p. 8] — and emphasis framing, "a form of framing that involves manipulating the content of a communication" [Cacciatore, Scheufele and Iyengar, 2016, p. 8]. Equivalency framing focuses on *how* information is communicated using language to produce an effect; while emphasis framing focuses on *what* information is communicated by different topics to produce an effect [Cacciatore, Scheufele and Iyengar, 2016].

Prior research on framing of science and health information has more often focused on emphasis framing, identifying and documenting specific topics [Iyengar, 1989; Iyengar, 1991] used to describe scientific issues or controversies [Detenber et al., 2018; Huttunen and Hildén, 2014; Jones-Jang et al., 2020; McCauley, Minsky and Viswanath, 2013; Stewart, 2013; Xie, 2015], rather than equivalency framing. However, meaning is shaped not only by *what* information is highlighted in media messages but also *how* information is presented in media messages.

Media framing of COVID-19

The framing of discourse about COVID-19 in the mass media during the pandemic may be instrumental in shaping public opinion and behaviors. For instance, an analysis of 1.9 million Tweets posted about COVID-19 from January 23 to March 8, 2020 identified that the most prevalent topics were updates about the number of COVID-19 cases and related deaths, but discussions of COVID-19 symptoms and treatment were notably missing [Xue et al., 2020]. Researchers noted that when the CDC issued its first warning about COVID-19 on Twitter on February 10, 2020, this would have been an important time to provide guidance to the public about taking preventive measures [Xue et al., 2020].

Visual representations of COVID-19 also contribute to framing of COVID-19, which can influence public opinion and behavior. A study of 497 coronavirus cartoons published in South African print and online newspapers during the first five months of the pandemic found that cartoons often featured "spikey blobs with evil grins", [Joubert and Wasserman, 2020, p. 1]. These images emphasized spikes and striking colors (green which is associated with sickness or slime or red which is associated with danger) as well as anthropomorphic features to evoke the emotion of fear. The authors argued that these visual media representations of the coronavirus were "metaphorical expressions of broader anxieties, fears and

(mis)conceptions" [Joubert and Wasserman, 2020, p. 20]. Visualizations of the coronavirus such as these contributed to the spread of disinformation during the "COVID-19 'infodemic"' [Joubert and Wasserman, 2020, p. 20] in both print [Joubert and Wasserman, 2020] and social media [Cinelli et al., 2020].

Research questions

This exploratory study focused on an analysis of primary characters featured in children's YouTube videos about COVID-19 and messaging approaches used to convey scientific, health, and medical information about COVID-19 during the first eight months of the pandemic in the U.S. Drawing on social cognitive theory [Bandura, 1986; Bandura, 2009] and the literature reviewed above, this study used a content analysis to (1) document primary character attributes and health prevention behavior presented in the videos, (2) examine diverse representation of expert characters, and (3) investigate the discourse frames used to communicate scientific, health, and medical information in these videos. The following research questions were posed for this study:

RQ1: What were the demographic attributes of the primary characters featured in children's YouTube videos about COVID-19?

- *RQ1a*: What character types were used to portray primary characters?
- *RQ1b*: Did the primary characters demonstrate health protection behaviors?

RQ2: Did children's YouTube videos about COVID-19 feature expert characters (medical and health professionals and scientists)?

- *RQ2a*: What was the gender of first-appearing expert characters in the videos?
- *RQ2b*: What was the race/ethnicity of first-appearing expert characters in the videos?

RQ3: How were coronavirus characters portrayed in children's YouTube videos?

RQ4: What discourse frames were used to convey scientific and health information about COVID-19 in children's YouTube videos?

RQ5: Are there differences in the use of discourse frames for children's YouTube videos created before the CDC issued guidelines for communicating about COVID-19 to children and videos created after the CDC guidelines were released?

Method

Sample

Google keyword searches were used to identify YouTube videos about COVID-19 that appeared online from February to September 2020. For this study, children's YouTube videos were defined as those that specifically addressed children and youth from preschool-age to adolescence. In order to identify YouTube videos that targeted these age groups, the keywords "children/kids/teens" were used in searches for YouTube videos and two researchers watched all videos, eliminating those that addressed adult viewers or focused on news stories for adult audiences. Two searches were conducted for this study. The first search included videos posted following initial news reports of the pandemic in the U.S. The following

keywords and phrases were used: "explaining COVID-19 to children/kids/teens", "explaining social distancing to children/kids/teens", and "explaining face masks to children/kids/teens" yielding 66 YouTube videos. The second search was conducted using key phrases derived from the CDC's recommendations for best practices for communicating about COVID-19 with children [Centers for Disease Control and Prevention, 2020]. The following key phrases were used: "explaining to children how COVID-19 spreads", "explaining to children hand washing", "explaining to children how to avoid close contact", "explaining to children how to cover your nose and mouth with a mask", "explaining to children how to cover coughs and sneezes", "explaining to children how to clean and disinfect", and "explaining to children how to monitor your health daily health", yielding 90 videos. To qualify as a children's video, the video needed to target or address preschool-aged children (4 and younger) to early adolescents (9–12) [YouTube, 2021]. Videos that targeted adult audiences, were longer than 20 minutes, and were duplicates were removed, yielding a total of 136 videos for analysis (see appendix A). Most of the videos were produced and posted by non-profit and health organizations; few were produced and posted by everyday citizens (see appendix A). While the searches did not limit the sample to educational videos, most of the videos were educational in nature. Information about each video was recorded to describe: (1) title/URL, (2) posting date, (3) posting source, (4) video play time, (5) number of views, (6) number of likes, and (7) number of dislikes (appendix A).

Coding and procedures

Each video was treated as the unit of analysis for this content analysis. A codebook was created to guide analysis, listing examples of video content illustrating each code or variable of interest. The definitions of the variables coded for this study are listed below.

Production features, indicative of the technical characteristics of a video, were coded. Audio format was coded for voice-overs (adult vs. child), music, and other. Video format was coded for the categories of live action (cartoon vs. human), text-only, graphics-only, and other.

Demographic attributes were coded for primary characters by character type (human, animated), gender (male, female, undetermined), age (baby, child/teen, adult, elderly adult, undetermined), and race/ethnicity (White, Black, Hispanic/Latinx, Asian, undetermined). Primary characters were identified as the first appearing character or featured narrator in a video.

Character type was coded for the primary characters (doctor, scientist, other adult, child, muppet, coronavirus, or undetermined). Physical characteristics, attire, setting, and character titles mentioned in the video or appearing on screen were used to determine character type.

Expert characters included health professionals (doctors, nurses, public health officials, psychologists) and scientists. The setting in which the characters appeared on the video (hospital, doctor's office, laboratory), the attire worn by the character (stethoscope, lab coat), and titles of characters mentioned in the video or appearing on screen were used to identify expert characters.

Coronavirus character expression was coded for visual representations of the coronavirus, which appeared in some videos. To investigate how coronavirus characters were portrayed to children, the expression of the character ("happy/smiling", "unhappy/frowning", "scary/frightening", "neutral/subdued", or other) was coded.

Discourse frames were coded for statements presented in the videos by the narrator and any other character who appeared in the video to communicate information about COVID-19. Discourse frames were identified by viewing videos and reviewing video transcripts to identify and record emergent patterns related to language use or discourse frame use in the videos. Information about COVID-19 was primarily conveyed or communicated in these videos using statements that either provided objective, factual information about COVID-19, attempted to influence or persuade viewers to adopt specific behaviors, or featured short, firm, direct commands about specific behaviors that should be adopted. Thus, the primary or dominant recurring discourse frames found were: *informative*, *persuasive*, and *directive*. The total number of each of these three discourse frames was identified, coded, and counted for each video. If a video presented more than one type of discourse frame, then all discourse frames used in the video were counted. The total number of discourse frames across all videos was then determined.

The *informative discourse frame* described facts associated with the virus. These facts were coded for statements about: 1) origin of the virus (country, animal host, animal/human host, animal consumption, and other); 2) physical appearance of the virus (shape, size, color, and other); 3) methods of transmission (animal to human, human to human, droplets, utensil sharing, surface contact, and other); 4) symptoms (fever, running nose, cough, breathing problem, vomiting, diarrhea, pneumonia, lung fluid, and other); 5) social consequences (virus sickens people, missing grandparents/friends/school, indoor/outdoor out-of-home activities, inconveniences; and other); and 6) treatment (hospitalization, quarantine, and other treatments).

The *persuasive discourse frame* described four different behavioral dimensions associated with the pandemic experience. These dimensions were coded for statements: 1) demonstrating empowerment (fighting the virus, being a superhero, and embodying other types of power); 2) showing fear (the virus could hurt and hospitalize you and others, virus is scary and dangerous, and other); 3) taking responsibility (doing the right thing, exhibiting cooperative behavior, taking care of others, keeping others safe, and other); 4) receiving reassurance (doctors/scientists being helpful, people staying calm, people getting better, kids being less sick than adults, virus going away, immune system overcoming virus, and other).

The *directive discourse frame* described or illustrated the practice of protective measures associated with slowing transmission of the virus. These statements included information about: 1) good hygiene (washing hands, using sanitizer, coughing/sneezing in tissue, coughing into elbow, not touching face, not touching others, and other); 2) self-care (getting enough rest, eating healthy, engaging in exercise, getting sunlight, and other); 3) physical distancing (staying home when sick, keeping physical distance, avoiding crowds, keeping away from grandparents, and other); 4) protective behavior (wearing a facial mask, wearing

gloves, telling others when feeling sick, seeking medical care, keeping home/surfaces clean, and other); and 5) adaptive coping (talking to others when feeling overwhelmed, limiting social media/news exposure, staying connected with friends/family, and other).

Intercoder reliability

Two graduate assistants were trained in use of the codebook. The coders practiced using the codebook using a think-aloud procedure to discuss their coding selections, questions, and discrepancies while coding two randomly selected videos from both samples. Next, an iterative process was used to assess intercoder reliability. First, coders independently coded all variables for 10 percent of the total sample and intercoder reliability scores were calculated. Next, coders independently coded 15 percent of total sample and intercoder reliability scores were calculated.[1] At both times, coders discussed discrepancies with the research team. Discrepancies were resolved and modifications were made to the codebook. Scott's pi [Scott, 1955] was used to assess the level of interrater reliability for each variable based on the procedure recommended by DFreelon.org [Freelon, 2010]. A total of 26 out of 29 variables achieved intercoder reliabilities ranging from .80 (one variable) to 1 (10 variables), with 15 variables with scores in the range of .83–.96. Only three variables fell below .80: two at .79 and one at .71. Intercoder reliability results were deemed largely sufficient for meeting reported standards [Lombard, Snyder-Duch and Bracken, 2002], considering the large number of variables and the latent nature of the video content. Following the second round of reliability checks, the two coders coded the rest of the sample independently.

Results

Description of videos

The overall frequency of occurrence of the following video formats in the COVID-19 children's videos were: 108 (34.7%) for print/text only, 94 (30.2%) for graphics only, 56 (18%) for live-action animation/cartoons, and 5 (14.5%) for live-action human actors. The overall frequency of occurrence of the following audio formats was: 109 (61.6%) for music, 46 (26%) for adult voiceovers, and 18 (10.2%) for child voiceovers. Many of the videos included more than one video format or audio format; subsequently, each type of video format or audio format was coded for each video.

Primary characters

RQ1 focused on examining the demographic attributes of primary characters. Findings indicated that a total of 57 primary characters appeared in the videos. They were about equally as likely to be men or boys ($n = 25$, 43.9%) or women or girls ($n = 24$, 42.1%). A majority of the primary characters were white ($n = 34$, 59.6%) and equally likely to be adults or elderly adults ($n = 22$, 38.6%) or children/teens ($n = 22$, 38.6%) (Table 1).

[1] None of the videos from the first reliability check were coded in the second reliability check.

Table 1. Frequencies and percent for demographic attributes of primary characters ($N = 57$).

Demographic attributes	*N*	%
Character type		
Human	42	73.7
Animated	15	26.3
Gender		
Male	25	43.9
Female	24	42.1
Cannot determine	8	14.0
Age		
Baby	8	14.0
Child/teen	22	38.6
Adult	18	31.6
Elderly adult	4	7.0
Cannot determine	5	8.8
Race/Ethnicity		
White/Caucasian	34	59.6
Black/African American	5	8.8
Asian	5	8.8
Hispanic/Latino	1	1.8
Cannot determine	12	21.1

Table 2. Frequency of primary character ($N = 57$) by character type.

Character type	*N*	%
Adult (other)	21	36.8
Child	16	28.1
Doctor	12	21.1
Scientist	3	5.2
Muppet	3	5.2
Coronavirus	2	3.5

RQ1a investigated the character type or characterization of the primary characters. The majority were adults ($n = 21$, 36.8%) who were not doctors or scientists, followed by children ($n = 16$, 28.1%), doctors ($n = 12$, 21.1%), scientists ($n = 3$, 5.2%), muppet characters ($n = 3$, 5.2%), and coronavirus characters ($n = 2$, 3.5%) (see Table 2).

RQ1b investigated whether the primary role model characters demonstrated health protection behaviors. The number of instances of health protection behaviors demonstrated by primary characters are as follows: 16 (22.9%) coughing into your arm, 15 (21.9%) washing hands, 14 (20.0%), wearing a face mask, 7 (10.0%), using hand sanitizer, 7 (10.0%), distancing from others, and 11 (15.7%) demonstrating other preventive health behaviors (see Table 3). Only 30.9% of videos featured a primary role model character who demonstrated health protection behaviors and

Table 3. Frequency of preventative health behaviors demonstrated by primary characters.

	N	%
Coughing into arm	16	22.9
Handwashing	15	21.9
Masking	14	20
Hand sanitizing	7	10
Distancing	7	10
Other preventative behavior(s)	11	15.7

Note. Characters may demonstrate more than one preventive health behavior.

69.1% of videos featured primary role model character who did not demonstrate health protection behaviors. Some of the primary characters featured in the videos demonstrated multiple health protection behaviors. It is important to note that this analysis did not consider whether other characters appearing in the videos also demonstrated health protection behaviors.

Expert characters

RQ2 investigated if children's YouTube videos about COVID-19 featured expert characters (*medical or health professionals* and *scientists*). The first-appearing expert character was coded.[2] A total of 52 (38.2%) videos featured *medical or health professionals* (doctors, nurses, public health officials, psychiatrists) and 23 (16.9%) videos featured *scientists* as expert characters.

RQ2a examined the gender of the first-appearing expert characters. As reported in Table 4, the gender of the first-appearing expert *medical or health professional* shown in the videos was 27 (51.9%) men, 19 (36.5%) women, and 6 (11.5%) gender could not be determined. The gender of the first-appearing scientist in the videos was 10 (43.5%) women, 8 (34.8%) men, and 5 (21.7%) gender not determined.[3]

RQ2b investigated the race/ethnicity of the first-appearing expert characters. As reported in Table 5, the race/ethnicity of the first-appearing expert *medical or health professional* was determined to be 31 (59.6%) white, 7 (13.5%) Black or African American, 2 (3.8%) Asian, 1 (1.9%) Hispanic or Latinx, and 11 (21.2%) as race/ethnicity could not be determined. An analysis of the race/ethnicity of the first-appearing *scientist* in the videos was determined to be 9 (39.1%) white, 5 (21.7%) Black or African American, 1 (4.4%) Asian, and 1 (4.4%) Hispanic or

[2]Some, but not all, of the expert characters were primary characters in the videos.

[3]The original research questions did not compare the number of men and women adult characters in expert roles (*medical or other health professionals*, *scientists*). However, a Chi-Square Goodness of Fit Test was conducted to determine whether the proportion of women *medical or other health professional* characters was equal to the proportion of men *medical or other health professional* characters. The proportions did not differ by gender, $\chi^2(\text{women}, n = 27, \text{men}, n = 19) = 1.39$, $p = 0.07$. A Chi-Square Goodness of Fit Test was performed to determine whether the proportion of women *scientist* characters was equal to the proportion of men *scientist* characters. The proportions did not differ by gender, $\chi^2(\text{women}, n = 10, \text{men}, n = 8) = 0.22$, $p = 0.11$. No significant statistical difference was found for either of these comparisons.

Table 4. Frequency of first appearing expert (doctor and scientist) characters in videos by gender.

Doctor character	*N*	%	*Scientist character*	*N*	%
Male	27	51.9	Male	8	34.8
Female	19	36.5	Female	10	43.5
Cannot be determined	6	11.5	Cannot be determined	5	21.7
Total	52	100	Total	23	100

Note. Most videos ($n = 84$) did not have any expert (doctor/scientist) characters.

Table 5. Frequency of expert (doctor and scientist) characters in videos by race.

Doctor character	*N*	%	*Scientist character*	*N*	%
White/Caucasian	31	59.6	White/Caucasian	9	39.1
Black/African American	7	13.5	Black/African American	5	21.7
Hispanic/Latinx	1	1.9	Hispanic/Latinx	1	4.4
Asian	2	3.8	Asian	1	4.4
Cannot be determined	11	21.2	Cannot be determined	7	30.4
Total	52	100	Total	23	100

Note. Most videos ($n = 84$) did not have any expert (doctor/scientist) characters.

Latinx, with another 7 (30.4%) whose race/ethnicity could not be determined (see Table 5).

Coronavirus characters

RQ3 focused on the ways in which coronavirus characters were portrayed on the videos. The content analysis of the expressions on the faces of all-appearing coronavirus characters in the videos showed that most coronavirus characters had neutral expressions, followed in frequency by those who had scary or frightening expressions. Of all 103 coronavirus characters featured in the YouTube videos, 61 (59.2%) had neutral expressions, 20.4 (21%) had scary or frightening expressions, 10 (9.7%) had frowning or unhappy expressions, 8 (7.8%) had happy expressions, and 3 (2.9%) did not show any specific emotional expression.

Discourse frames

RQ4 focused on exploring the types of discourse frames (*informative*, *persuasive*, *directive*) used in the videos. Results showed that the *directive frame* ($n = 565$) represented half (50.0%), the *informative frame* ($n = 385$) reflected about one-third (34.0%), and the *persuasive frame* ($n = 178$) constituted over one-tenth (16%) of the 1,128 discourse frames analyzed.

RQ5 examined whether there were differences in the use of discourse frames for videos created before the CDC issued guidelines for communicating about COVID-19 to children and for videos created after these guidelines were released.

Table 6. Directive discourse frames present before and after the CDC issued guidelines for communicating about COVID-19 to children.

Directive frames	*No guidelines* $N = 106$			*With guidelines* $N = 30$		
	N	%	*M*	*N*	%	*M*
Good hygiene	249	55.7	2.35	62	52.54	2.07
Health habits	32	7.16	.30	3	2.54	.10
Distancing	87	19.46	.82	22	18.64	.73
Protective	48	10.74	.45	28	23.73	.93
Self-care	31	6.94	.29	3	2.54	.10

Note. Several different types of directive discourse frames may be present in a video.

Table 7. Informative discourse frames present before and after the CDC issued guidelines for communicating about COVID-19 to children.

Informative frames	*No guidelines* $N = 106$			*With guidelines* $N = 30$		
	N	%	*M*	*N*	%	*M*
Origin	27	7.76	.26	1	2.70	.03
Description	35	10.06	.33	3	8.11	.10
Transmission	109	31.32	1.03	23	62.16	.77
Symptoms	135	38.79	1.27	7	18.92	.23
Inconveniences	30	8.62	.28	1	2.7	.03
Treatment	12	3.45	.11	2	5.41	.07

Note. Several different types of informative discourse frames may be present in a video.

Differences in the use of *directive frames* were considered for the two different time periods. Descriptive analyses noted an increase in the percentage of discourse frames that used protective statements and decreases in the percentages of discourse frame statements about health habits and self-care for videos appearing after CDC guidelines were issued (Table 6).

As noted in Table 7, differences in the use of *informative frames* were also found. The percentages of discourse frames that featured statements about the origin of the virus, symptoms, and inconveniences decreased in videos appearing after the CDC guidelines were issued. However, the percentage of the discourse frame that included statements about transmission of the virus doubled in videos appearing after these guidelines were released.

Descriptive analyses of the use of *persuasive frames* indicated changes in the percentages of all types of persuasive statements for videos appearing after the guidelines (Table 8). For example, the percentages of statements expressing power, fear, and reassurance all decreased while the use of statements expressing guilt and responsibility increased in videos appearing after the guidelines were released.

Table 8. Persuasive discourse frames present before and after the CDC issued guidelines for communicating about COVID-19 to children.

Persuasive frames	*No guidelines* $N = 106$			*With guidelines* $N = 30$		
	N	%	*M*	*N*	%	*M*
Power	7	4.35	.06	0	0	0
Fear	39	24.22	.37	2	11.76	.07
Guilt	8	4.97	.08	3	17.65	.10
Responsibility	27	16.77	.26	8	47.06	.27
Reassurance	80	49.69	.76	4	23.53	.13

Note. Several different types of persuasive discourse frames may be present in a video.

Discussion

Overall, this study provided valuable information about portrayals of primary characters as role models in digital media and the type of message framing used in children's YouTube videos about COVID-19 during the fight against transmission of COVID-19. The sudden emergence of COVID-19 as a public health crisis presented a unique communication challenge that required promoting an understanding of the disease for children and encouraging behavioral change to slow and prevent transmission of the virus. Effective communication of science, health, and medical information to children is a complex but critical and often overlooked area of research. The importance of research in this area is further underscored by the growing popularity of social media platforms, such as YouTube, as a source of science and health information [Brossard and Scheufele, 2013] and as a preferred medium among children [Jaakkola, 2020; Smith, Toor and van Kessel, 2018]. This exploratory study advanced extant research in this area by examining attributes of primary characters and the extent to which these characters demonstrated and modeled recommended health protection behavior, the diverse representation of expert characters, and the messaging approaches used in children's YouTube videos to convey scientific, health, and medical information during a global pandemic.

Findings from the current study showed that the primary characters appearing in children's YouTube videos about COVID-19 were most often adults. While approximately an equal number of primary characters were men and women, most primary characters were white and few were from diverse racial and ethnic backgrounds. Portrayals of adult characters as role models in these videos are important because social learning research has found that children learn from adult media models, especially when children perceive adult models as nurturing and to be in high power positions [Bandura, 1963]. However, the lack of primary role models from diverse racial and ethnic backgrounds is of concern because prior research has found that same-race role models are important for identification [Liss, 1981] and because of the reported health disparities, including hospitalization rates, from COVID-19, which were disproportionally higher for Black and Hispanic children in many U.S. states [Kim et al., 2020].

This study showed that many of the primary characters demonstrated and modeled health protection behaviors such as hand washing, coughing into their

arms, wearing masks, and using hand sanitizer. However, more than twice as many videos did not feature a primary character demonstrating health protection behaviors than those that did. It is important to note that this study did not consider whether other characters appearing in the videos demonstrated protective health behaviors Social cognitive theory predicts that modeling of desired behavior exhibited by media models is likely to promote that behavior among children [Bandura, 1963; Bandura, Ross and Ross, 1963b]. In line with prior research on children's learning from television programs, it is expected that children also would learn to model the behavior of role model characters appearing in the YouTube videos. A meta-analysis of 24 studies found that children's viewing of *Sesame Street* was associated with learning about "health and safety-related practices such as washing one's hands or wearing a bike helmet" [Mares and Pan, 2013, p. 148].

Research findings indicated that adult expert characters (*medical or health professionals* and *scientists*) appeared to some extent in these videos about COVID-19. Most of the videos, however, did not feature expert characters. Adult expert characters depicted as doctors and other medical professionals were featured much more often than adult expert characters depicted as scientists. Some adult expert characters demonstrated and modeled health protection behaviors such as hand washing, coughing into an elbow, or wearing a mask. Media models portrayed as medical or health experts may be important for effective communication to promote adoption of health protection behaviors through identificatory learning [Bandura, 1963], and thus potentially, shape children's perceptions of and attitudes when important public health issues emerge. Other studies suggest that children are likely identify with experts, like those shown in these videos, when children perceive these characters as being in positions of high power [Bandura, 1963].

Findings from this study related to diverse portrayals of adult expert medical or health professional characters and scientist characters were mixed. Women were less likely to be represented as medical or health experts on these YouTube videos compared with their representation in the U.S. workforce. Findings from this study indicated that more men (51.9%) than women (36.5%) were depicted as expert medical or health professionals. Of all employed in health-related occupations in the actual U.S. workforce, 69.7% are female and 30.3% are male [National Center for Science and Engineering Statistics, 2021]. Interestingly, findings from this study found more women scientists (43.5%) than men scientists (34.8%) shown in these videos. Of all employed scientists and engineers in the actual U.S. workforce, 70.6% are male and 29.4% are female [National Center for Science and Engineering Statistics, 2021]. For both expert medical or health professional and scientist character portrayals, the representation of groups that have experienced exclusion and discrimination in the medical or health and STEM workforce were underrepresented in proportions similar to their underrepresentation in the actual U.S. workforce. Findings from this study on the race or ethnicity of the first-appearing expert *medical or health professional* indicated 31 (59.6%) white, 7 (13.5%) Black or African American, 2 (3.8%) Asian, 1 (1.9%) Hispanic or Latino, and 11 (21.2%) whose race or ethnicity could not be determined. For all ethnicities and races employed in health-related, occupations in the U.S., 67.9% were white, 11.8% were Black or African American, 9.2% were Asian, 9.2% were Hispanic or Latino, and 2.0% were more than one race, unknown, or other [National Center for

Science and Engineering Statistics, 2021]. Findings from this study on the race or ethnicity of the first-appearing *scientist* in the videos indicated 9 (39.1%) were white, 5 (21.7%) were Black or African American, 1 (4.4%) was Asian, and 1 (4.4%) was Hispanic or Latinx, with another 7 (30.4%) whose race/ethnicity could not be determined. For all ethnicities and races employed in STEM occupations in the U.S., 64.5% were white, 18.1% were Asian, 8.1% were Hispanic or Latino, 7.4% were Black or African American, and 2.0% were more than one race, unknown, or other [National Center for Science and Engineering Statistics, 2021]. Overall, these findings call for more diverse and inclusive gender as well as racial and ethnic diversity in portrayals of adult expert characters to best promote identification for children of diverse backgrounds. Prior research has highlighted the importance of same-gender and same-race and ethnicity role models in promoting positive behavior among children [Carsten Conner and Danielson, 2016; Villiers et al., 2015].

Findings also revealed that animated anthropomorphic depictions of the coronavirus appeared in YouTube children's videos about COVID-19. While most of the coronavirus anthropomorphisms were shown with a neutral expression, the next most common expression shown was a scary or frightening expression. The influence of visual representations on emotions has been noted in prior studies [Powell et al., 2015], and this influence can also impact and motivate behavior [Krause and Bucy, 2018]. Prior research has found that anthropomorphic depictions promote children's learning from media [Bonus and Mares, 2018]. However, other research on anthropomorphic depictions of coronavirus in newspaper cartoons noted that these visual representations convey "broader anxieties, fears and (mis)conceptions" [Joubert and Wasserman, 2020, p. 20] that shape negatively public attitudes and perceptions. Further, the formal features (bright colors, abrupt movement) exhibited by many of these anthropomorphic depictions of the coronavirus may attract children's attention — either towards or away from important health protective messaging — and potentially making these depictions more salient for and having a greater or less influence on young viewers.

Findings from the current study show how language conveyed through discourse frames about COVID-19 was used to urgently communicate important social rules and expected norms of behavior to children in order to combat this major public health crisis. The three discourse frames examined in this study were manifested differently in the YouTube videos and varied in their frequency of appearance. Language has been described not only as a communicatory vehicle but also as a social practice that conveys and reinforces "tacitly understood rules and forms of behaviour which regulate ordinary life practices" [Taylor, 2013, p. 11]. As one researcher explained: "The words and terms used in various contexts, officially and colloquially, are part of the chain; the language is inseparable from the social phenomenon" [Taylor, 2013, p. 9].

The use of the directive discourse frame appeared to be adopted most frequently to communicate health information, in particular, related to promoting personal and public health. Direct statements about ways to prevent transmission of the virus were frequent such as those found in the video by Healthwise [2020]: "Stay home to avoid people who might be infected". "Avoid touching your mouth, nose, and eyes". "Stay home when you are sick and ask people not to visit you". There are several possible explanations for the frequent use of the directive frame. First, directive discourse frames mirror a frequent parent-to-child communicative style

when parents are concerned about children's safety and well-being, and especially for communication with young children. Second, directive discourse frames present information in a clear and straight-forward manner that is most likely to be most assessible and easy for children to understand because information is conveyed in a simple, concise, and clear manner. Third, directive discourse frames convey authority and certainty.

Prior research has suggested that direct forms of communication may be more compelling, noting that "scientists need to be affirmative when communicating about scientific issues: polite and vague message styles may make scientists look weak and vacillating" [Yuan, Ma and Besley, 2019, p. 285]. The predominant use of directive discourse frames, thus, could also be related to the need for direct communication about the severity of the pandemic. Importantly, the percentage of protective statements in videos appearing after the CDC announced guidelines on how to discuss the virus with children increased. This may underscore the sense of urgency needed to communicate the importance of protecting children from contracting the virus and then transmitting the virus to others in their family. Such transmission could be especially worrisome for older adults (e.g., grandparents), individuals with chronic conditions, and those who are immunocompromised.

Although less frequent, informative discourse frames also were found in children's YouTube videos about COVID-19. Informative discourse frames focused on facts about the coronavirus such as those provided in the video by High Impact [2020]: "COVID-19 is believed to be transmitted primarily through inhalation". "Once infected most people experience, mild symptoms including sore throat, headache, fever, a dry cough, shortness of breath, and fatigue". Informative frames may be especially critical for promoting children's learning and understanding of complex information about the virus, transmission, symptoms, and treatment. This seems especially relevant for videos after the CDC issued its COVID-19 communication guidelines targeting children. However, findings showed that the percentages of statements about COVID-19 origins, symptoms, and inconveniences decreased while the percentage of statements about transmission increased in videos appearing after the guidelines were issued. While a large number of videos both before and after issuance of the guidelines discussed transmission, this finding highlights an increase in the percentage of videos featuring statements about transmission after the guidelines were released. Overall, this indicated that these videos focused even more on the need for children to physically distance from others in order to protect themselves and others from contracting and transmitting the virus.

Persuasive discourse frames were the least likely discourse frame to appear in these videos. However, persuasive framing may be important for understanding motivation for adopting protective health measures. Persuasive discourse frames varied in the type of appeal. Some videos featured reassuring discourse frames like the frame in the video by BayCare [2020]: "Wearing a mask is one way that we can help keep everyone safe". Others featured fear-inducing discourse frames like the frame used in video by Healthwise [2020]: "COVID-19 is new and has not been seen in people before" and "For some people it can become serious and dangerous". Interestingly, the use of both the fear-inducing and reassuring frames significantly decreased, after the CDC published its guidelines for communicating with children about COVID-19. It appears that less emphasis on the threat caused

by the virus combined with statements expressing confidence in overcoming that threat may be a good combination in helping children understand the serious nature of the pandemic without conveying additional fear or unrealistic assurance. Prior research has found fear appeals effective in promoting positive health behaviors about food consumption [Bleakley et al., 2015; Charry and Demoulin, 2012]. However, other research has found that message framing focused outcomes (gain vs. loss) and message polarity (affirmation vs. negation) were important considerations when developing Public Service Announcements (PSAs) for children designed to promote behavioral changes [Wyllie, Baxter and Kulczynski, 2015]. To date, little research has considered the most effective discourse frames for communication of scientific and health information to children.

Study limitations and future research

The potential influence of role model characters and discourse frames on science and health communication for children is an important and understudied area of research. This exploratory study addressed this gap and provided a foundation for future research on media content and media effects in this area. This study provided useful information and an interesting framework for better understanding science, health, and medical communication to children; however, there were several limitations of this research.

First, the sample size was relatively small. During the sampling timeframe, there were relatively few COVID-19 videos *specifically created for children* posted on YouTube. Future research could consider how other media communicated information about COVID-19 to children to better determine how multiple media sources conveyed information about the virus and protective health behaviors during the pandemic. Second, the overall sample of videos analyzed for this study was limited by the search terms used to identify the videos. However, multiple keyword combinations and terms were used (e.g., kids, teens) to obtain as large and as comprehensive a sample of YouTube children's videos about COVID-19 as possible. In addition, an even broader list of search terms for specific health protection behaviors was used in the second sampling of videos. Third, while this content analysis offered valuable baseline data for assessing portrayals of role model characters and discourse frames, future research should also consider other variables considered to be effective for science and health communication with children. Fourth, it is important to extend this research through audience studies that assess the actual effects of viewing these YouTube videos of COVID-19 on children's attitudes and behaviors. It is critical to assess which primary characters (including expert and anthropomorphic coronavirus characters) are most effective in communicating risks and promoting the adoption of health protection behaviors. In addition, it is important to determine which specific messaging strategies and discourse frames are most effective for science and health communication for children. While it was beyond the scope of this study to provide information about the effects of these videos on the target audience, these effects are important to assess. Similarly, while an analysis of production goals and conventions also were beyond the scope of the current study, future research should consider their impact on messaging content and design.

Despite these limitations, providing descriptive information about the content of these videos related to the characters featured and messaging approaches used is

an important first step. To extend research with this focus, future research, for example, could further explore the effects of role model portrayals, role model demonstration of health protection behaviors, and discourse frames on children's understanding of the science, health, and medical content and on the adoption of health protection behaviors. The variety of discourse frames used to communicate information about COVID-19 to children during this global pandemic underscores the need to examine the effects of these discourse frames on children. Future audience research assessing the effects of specific types of discourse frames in science videos for children could help determine the most effective ways of presenting science, health, and medical information to promote attention, engagement, learning, recall, and understanding. Additional work could also consider whether different types of discourses (informative, directive, persuasive) are more influential than others or more developmentally appropriate than others, especially given the wide range of ages targeted in children's YouTube videos about COVID-19. The persuasive frames that emphasized social responsibility as a form of persuasion is another important area of research. For example, one previous study found that descriptive social-norm based health messages and those messages highlighting the healthy behaviors of others had a small effect on promoting healthy behavior related to eating fruits and vegetables [Sharps and Robinson, 2016].

Overall, additional research is needed on how children process information from YouTube videos about science, health, and medicine. What features are most engaging? What elements in these videos do children focus on? How do children process scientific, health, and medical information presented in the videos? Which discourse frames are most effective and for which health outcomes? How do children's interpretation vary by age? Future audience effects research with children also should examine analytics data on video viewers and consider individual differences in viewers' overall use, amount of time viewing, motivation for watching, attention span, and viewing context (formal or informal or blended), in addition to viewer's identities and demographics. Finally, given the prevalence of animated coronaviruses in these videos, further investigation of their potential effects should be considered. Prior research has stressed the importance of considering the influence of visual content on understanding of scientific issues, noting that visuals may be more influential than text [Powell et al., 2015].

Conclusion

The COVID-19 pandemic highlighted an urgent need to understand how to accurately and effectively communicate complex scientific and health information to young learners through media. The COVID-19 pandemic represents one of the most significant public health crises worldwide in recent years. As the pandemic evolved, initial concerns about children transmitting the virus to adults shifted to increased concerns about children contracting, being hospitalized, and dying from the virus. In the first two years of the pandemic, 296 children ages 0–4 and 644 children ages 5–18 died from COVID-19 in the U.S., according to the Centers for Disease Control (CDC), [Centers for Disease Control and Prevention, 2022]. While the development and approval of vaccines helped decrease the spread of the virus, effective communication to children about COVID-19 protective behaviors remained critical. Throughout the COVID-19 pandemic, YouTube was one likely source of information about the virus for children as well as a potentially useful medium for educating children about the virus.

This exploratory study provided important foundational knowledge about the media content and messaging in YouTube videos about COVID-19 created for children, focusing on the use of characterizations of role models and discourse frames appearing in these videos. Findings from this study identified YouTube video content related to the selection of the characters who served as spokespersons and also as role models. Many of these characters demonstrated health protection behaviors as well as provided information to educate children about the coronavirus. Findings from this study also highlighted how the use of anthropomorphic coronavirus characters were used to teach children *what to think* about the virus and also *how to think* about the virus through the facial expressions that conveyed emotion in these character depictions. In addition, study findings examined the use of various discourse frames used in communicating science, health, and medical information to children, highlighting how specific messages and values were embedded in the messages used to communicate about COVID-19 with children. Finally, the YouTube videos included in this study targeted a wide range of ages from the preschool years to adolescence.

This exploratory study also identified several important messaging features critical for understanding the potential effects of science, health, and medical communication YouTube videos on children's attitudes and behavioral change. Findings from this exploratory research study helped contribute to efforts to improve communication with children through digital media and offered important avenues for future research designed to better understand the potential influence of digital media content on young viewers. However, many questions and avenues for future research in this area remain. For example, future research should consider which characters (teachers, parents, doctors or other health professionals, scientists, peers, or others) are most effective role models in producing the desired health behavioral outcomes. The efficacy of matched gender and matched race and ethnicity role models is another important consideration. It is important for future research in this area to consider carefully how live-action and animated characters may vary in their appeal to children. In addition, it is important to consider how representations of anthropomorphic characters serve as visualizations and metaphors that affect children's emotions and shape their perceptions of health concerns. Future research needs to determine which types of discourse frames are most effective and most persuasive in urging children's adoption of protective health behaviors.

Digital media, like YouTube videos, are likely to appeal to many children because of the characters, engaging storytelling features, and action-focused nature of the medium. The growing popularity of YouTube videos among young viewers and their increasing access to YouTube videos underscore the importance of future research on their effects. Further, the increasing number of educators and practitioners creating YouTube videos as educational tools to convey information about science, health, and medicine emphasizes the need for more research on both its reach and effects. Educating children about public health issues is important, but the communication of scientific, health, and medical information to children is a challenging task. Scientific, health, and medical information is complex, and children and youth are active, not passive, users of popular media, and thus likely to engage differently with YouTube characters and YouTube message content. Additional research will help fill this gap in understanding how to most effectively create science, health, and medical content in digital media to best promote

attitudinal and behavioral change, for this important, and often overlooked, audience.

Appendix A. YouTube children's videos about COVID-19 (February–September, 2020)

Table 9. Description of children's YouTube videos.

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
The Coronavirus Explained to children https://www.YouTube.com/watch?v=MVvVTDhGqaA&vl=en	Eurac Research	3:07	3/17	621,062	2975	380
Coronavirus Outbreak ǀ How to protect yourself https://www.YouTube.com/watch?v=PkUlCIFE45M	Kids Learning Cartoon ǀ Dr. Panda TotoTime	6:13	3/7	1,931,998	10,052	1,646
What is Coronavirus? https://www.YouTube.com/watch?v=R-JbDMYmAQM	The Dr Binocs Show/Peekaboo Kidz	6:34	2/7	7,256,954	89,494	7,269
Coronavirus Explained! (for kids) https://www.YouTube.com/watch?v=OPsY-jLqaXM	Dr Michelle Dickinson	4:09	3/5	335,305	1,507	93
What is Coronavirus? An explainer for Children https://www.YouTube.com/watch?v=FqaXBtSaiUE	Ineqe Safeguarding Group	2:27	3/20	402,347	2,407	208
Coronavirus: How to Teach Kids About COVID-19 https://www.YouTube.com/watch?v=GoXxmzKdick	BrainPop	4:32	ND	1,949,558	10,984	761
Explaining coronavirus to kids https://www.YouTube.com/watch?v=J7FGrqt80dk	CBC News	1:26	3/27	117,772	549	95
ROBert explains the corona virus to children https://www.YouTube.com/watch?v=5DlOGKpMNs4	Playmobil	5:36	3/24	661,866	1,985	236
What is Coronavirus Explained for kids https://www.YouTube.com/watch?v=ZIrgoXM7snQ	Simpleshow	2:06	3/30	3,962	27	4
Coronavirus explained to kids (by a superhero) https://www.YouTube.com/watch?v=RHnU6LTWh6g	Elemental	3:57	3/26	128,440	582	61
CORONAVIRUS ǀ What Is Coronavirus? https://www.YouTube.com/watch?v=8d8_OKQMkU0	Kids Learning Tube	4:19	3/16	1,448,324	6,911	903
COVID-19 Germs Experiment for Kids! https://www.YouTube.com/watch?v=_KirHm_sYfI	NephCure Kidney International	1:28	3/16	529,451	2,790	272
What is CORONAVIRUS? AND How to PROTECT YOURSELF? https://www.YouTube.com/watch?v=FC4soCjxSOQ	FreeMedEducation	1:59	2/13	1,391,851	10,568	518
Corona Virus ǀ Coronavirus Facts for Kids ǀ What is Coronavirus in China https://www.YouTube.com/watch?v=c_m_iuUVSlw	Hey! Guess What	6:45	1/27	38,316	209	21
What is a Coronavirus? https://www.YouTube.com/watch?v=jgGdQkXJENA	It's AumSum Time	4:56	2/21	840,679	12,530	496

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
Child-Friendly Ways to Address COVID-19 https://www.YouTube.com/watch?v=i-wWz_SUyb4	NYU Langone Health	5:40	4/22	215,790	1,034	115
Coronavirus (COVID-19) https://www.YouTube.com/watch?v=vxIzke8IISQ	Learning Junction	3:25	3/21	67,380	385	53
Why It's Important To Stay Home: Explaining The Coronavirus Pandemic To Kids https://www.YouTube.com/watch?v=ZxB-vohL4WA	Radio Free Europe/Radio Liberty	1:38	3/26	47,835	406	59
The Coronavirus Explained & What You Should Do https://www.YouTube.com/watch?v=BtN-goy9VOY	Kurzgesagt — In a Nutshell	8:34	3/19	29,541,234	955,496	14,172
5 facts every kid should know about the coronavirus https://www.YouTube.com/watch?v=WwQMtSI3i5I	Science Mom	5:02	3/4	67,603	881	37
How To See Germs Spread Experiment (Coronavirus) https://www.YouTube.com/watch?v=I5-dI74zxPg	Mark Rober	10:20	3/18	20,837,517	590,474	9,181
Doctor explaining CoronaVirus to Kids https://www.YouTube.com/watch?v=u4hF2_iMW6U	Dr Simi Adedeji	3:52	3/21	N/A	N/A	N/A
Kid's Video Guide to Coronavirus https://www.YouTube.com/watch?v=gxwslU2eGH0	Children's National Hospital	1:21	3/24	158,723	950	93
How To Explain Coronavirus To Children (English) https://www.YouTube.com/watch?v=U5Abn3bJSlI	Beautiful Healthy Lifestyle	3:18	3/16	1,050	10	0
#Coronavirus Explained for Kids https://www.YouTube.com/watch?v=L-n8uNNnS38	Lingokids – The Playlearning App	1:30	3/13	199,555	507	72
Coronavirus Information for Kids https://www.YouTube.com/watch?v=kiVpWZBXLug	Counselor Keri	4:28	3/15	59,927	313	31
Coronavirus Safety for Children https://www.YouTube.com/watch?time_continue=16&v=eNvS4BqfnHE&feature=emb_logo	YodellingYak	2:11	ND	4,458	36	5
Corona Virus Explained For Kids https://www.YouTube.com/watch?v=HFiQUYVT7Lo	Phanganist	3:42	4/8	282	12	0
Coronavirus Advice for KIDS https://www.YouTube.com/watch?v=AvLk1g_t_-E	QuadSquad	3:50	3/19	37,322	57	4
COVID-19 explained to children in under 5 minutes https://www.YouTube.com/watch?v=PjJ4ygQUSRU	Chaire de recherche sur le numérique en éducation	5:08	3/29	N/A	N/A	N/A
How to Explain Social Distancing to Kids https://www.YouTube.com/watch?v=2HTA3ql6uWY	Kiwi Co	1:31	3/21	125,661	559	44
Covid-19 Explained https://www.YouTube.com/watch?v=k3mn_42dAmk	Queensland Department of Education	1:20	4/1	50,086	N/A	N/A

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
All about Coronavirus: A Video for Kids and Their Families https://www.YouTube.com/watch?v=6lJQ123_4e8	University of Michigan School of Public Health	2:31	5/21	56,691	331	18
Safety Measures For CORONAVIRUS https://www.YouTube.com/watch?v=TSkEwdzGbCA	Dr Binocs Show | Peekaboo Kidz	6:15	3/17	2,227,048	24,104	1,811
Kids Explain the Coronavirus https://www.YouTube.com/watch?v=kLOZ4KcEJtc	The Atlantic	3:59	4/14	66,105	525	54
Symptoms of Coronavirus https://www.YouTube.com/watch?v=6p9t6rPExpQ	It's AumSumTime	5:09	4/9	1,788,731	10,224	1,147
Talking with Teens about Social Distancing – Coronavirus (COVID-19) https://www.YouTube.com/watch?v=zb2dgoRcJNc	Mytonomy	2:03	4/13	3,894	16	0
Teens Ask Questions and Get Answers – Coronavirus (COVID-19) https://www.YouTube.com/watch?v=W5roFzk0pOo	Mytonomy	2:50	4/13	10,554	81	10
Social Distancing Explained https://www.YouTube.com/watch?v=QtNZZWLdoeo	Ochsner Health	2:11	4/14	76,972	415	43
Physical Distancing https://www.YouTube.com/watch?v=Ghwj3hNcBnE	UC Irvine	1:47	6/6	10,523	115	35
Social Distancing: A Kid-Friendly Explanation Using BrainPOP's Make-a-Movie https://www.YouTube.com/watch?v=FvTZv31eRp0	BrainPop	3:21	ND	151,137	619	101
Time to Come In, Bear: A Children's Story About Social Distancing https://www.YouTube.com/watch?v=DA_SsZFYw0w	Kim St. Lawrence	1:40	3/23	1,006,401	6,089	229
What does a kid like me need to know about COVID-19 (Coronavirus)? https://www.YouTube.com/watch?v=rZcLvZZdERw	Phoenix Children's Hospital	0.59	3/18	28,570	169	12
Covid-19 (coronavirus) – Explained for children https://www.YouTube.com/watch?v=IX3dpN91E1I	Ciaran Duffy	1:58	3/21	20,514	161	10
Kids Guide to COVID 19 https://www.YouTube.com/watch?v=T2c2-IQCzyo	Slim Goodbody	8:04	3/31	14,153	198	11
Understanding Coronavirus (COVID-19) https://www.YouTube.com/watch?v=KGFzNI1JnRA	funsciencedemos	4:05	3/13	8,036	197	7
Explained to Kids: Why We Are Wearing Masks https://www.YouTube.com/watch?v=mhCBXlPPOuw	Shandy Clinic	2:00	3/13	74,870	56	13
We Wear Masks – A Social Story about the coronavirus https://www.YouTube.com/watch?v=lnP-uMn6q_U	Mike McGovern	1:35	4/9	475,934	1,942	248

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
Wear A Mask Song For Kids | Mask Around Me https://www.YouTube.com/watch?v=a9QTxUklE0w	Drs Bop 'n Pop	3:10	4/12	803,985	760	663
Coronavirus explained for younger people https://www.YouTube.com/watch?v=sGYg6Kk3X1Q	RTÉ News	1:46	3/1	127,275	747	79
A More Scientific Understanding for Teens – Coronavirus (COVID-19) https://www.YouTube.com/watch?v=aLAXtBJWxhQ	Mytonomy	3:13	4/13	10,081	48	3
How to explain Corona to children | Stay Home Superheroes Animation | Parenting during Covid-19 https://www.youtube.com/watch?v=QNH6ZkpZVb4	MyDadReads	7:02	3/23	25,836	224	18
Mask vs No Mask Lab Results – Do they work? https://www.youtube.com/watch?v=qDeP7-rUZmo	AsapSCIENCE	10:52	07/23	646,608	27,772	1,805
COV-Ed: How to protect yourself and others against the spread of Coronavirus https://www.youtube.com/watch?v=PzyQ0Qhd4js	UBC Medicine – Educational Media	2:15	04/27	13,581	129	7
Kids Asking Questions About COVID-19 – How does a virus spread? https://www.youtube.com/watch?v=qIwXY-AfXJM	Shaw Community Link	1:23	04/20	113	0	0
COVID-19 PSA | How to Stop the Spread | BrainPOP https://www.youtube.com/watch?v=RX3LgoW2Y_Q	BrainPOP	2:49	07/17	227,964	1,297	81
Global COVID-19 Prevention https://www.youtube.com/watch?v=rAj38E7vrS8	Stanford Medicine	2:30	03/21	1,463,521	N/A	N/A
How coronavirus spreads outdoors vs. indoors https://www.youtube.com/watch?v=n6QwnzbRUyA	Vox	6:02	05/28	4,270,263	69,659	6,775
What is a coronavirus? – Elizabeth Cox https://www.youtube.com/watch?v=D9tTi-CDjDU	TED-Ed	5:15	05/14	1,199,237	25,614	588
COVID-19: Droplet Spread Explained https://www.youtube.com/watch?v=qa92mxLc5r4	Maricopa County	1:12	04/16	10,239	38	3
Social Distancing & COVID-19 Prevention Explained In 27 Seconds With Matches & Fire https://www.youtube.com/watch?v=00doYWSFw58	HeartValve Surgery.com	0:37	03/18	1,355,836	9,151	2,582
Reduce the spread of COVID-19: Wash your hands https://www.youtube.com/watch?v=o0P-0d1mJfA	Healthy Canadians	0:53	03/28	34,554	N/A	N/A
How does COVID19 spread? why Lockdown, Self-isolation, Physical distancing, and Quarantine is IMP https://www.youtube.com/watch?v=WNYB_o8MpcA	Dr. G Bhanu Prakash Animated Medical Videos	2:34	04/27	49,843	349	49

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
Explaining Covid 19 to children animation https://www.youtube.com/watch?v=JgYhwP5FXrs	Cardiff and Vale University Health Board	2:41	04/14	208	N/A	N/A
Can coronavirus be spread through talking or breathing? https://www.youtube.com/watch?v=6WonqHE2ccQ	Private video; no longer available	0:55	05/05	Private video	N/A	N/A
What is a virus? – Viruses for children – Science for Kids https://www.youtube.com/watch?v=GFm45J8d7HI	Smile and Learn – English	4:44	05/07	105,906	617	107
Coronavirus Animation: High Impact Demonstrates How COVID-19 Impacts the Body https://www.youtube.com/watch?v=78jLBNSqc3g	High Impact	1:56	03/20	1,159,130	7,609	522
Learn about hand hygiene and preventing the spread of coronavirus (COVID-19) https://www.youtube.com/watch?v=5JYhm9oa-DM	HSE Ireland	1:14	03/03	79,084	N/A	N/A
Coronavirus: Social Distancing https://www.youtube.com/watch?v=2WCtGFNENYU	Australian Government Department of Health	0:30	03/21	256,377	N/A	N/A
What Is COVID 19 https://www.youtube.com/watch?v=4pVXILBOsHQ	Healthwise	2:35	03/18	12,990	96	6
Coronavirus – seven steps to prevent the spread of the virus https://www.youtube.com/watch?v=8c_UJwLq8PI	World Health Organization (WHO)	0:30	03/13	1,112,742	12,165	551
Wearing a Mask Helps Stop the Spread of Germs https://www.youtube.com/watch?v=OLO1GNXKmNE	Meet the Helpers	0:55	04/29	129,646	366	67
We Wear Masks – A Social Story about the coronavirus https://www.youtube.com/watch?v=lnP-uMn6q_U	Mike McGovern	1:35	04/09	475,922	1,942	248
Handwashing Heroes https://www.youtube.com/watch?v=P5_2WojMWOc	Children's National Hospital	0:44	04/22	31,207	105	5
How to Wash Your Hands for Kids – WHO Technique – Coronavirus (COVID-19) Hand Washing video https://www.youtube.com/watch?v=DDjcJ-fSUgg	Kids Find Fun	2:09	05/08	274,997	1,148	160
COVID 19 Prevention | Steps of Hand Washing for Kids and Adults https://www.youtube.com/watch?v=fFM5pekgVl4	Clean Freak & Germaphobe	6:04	03/26	4,490	21	2
How to Wash Your Hands | BrainPOP Jr. https://www.youtube.com/watch?v=960XYPCAezU	BrainPOP	3:38	03/23	948,483	2,202	262
10 Steps to Washing Your Hands (Short Version) – Hygiene Habits for Kids https://www.youtube.com/watch?v=Br4sQmiJ1jU	Smile and Learn – English	2:02	08/04	75,496	633	73

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
Stop Germs from Spreading: Wash Your Hands | Cincinnati Children's https://www.youtube.com/watch?v=JD85FDlxqCs	Cincinnati Children's	1:00	03/20	186,758	540	77
What are Germs | Germ Facts for Kids | How To Wash Your Hands https://www.youtube.com/watch?v=Vl6r3ae0Xls	Hey! Guess What	13:01	03/09	113,839	746	103
Coronavirus (Covid-19) Hygiene Etiquette for Kids https://www.youtube.com/watch?v=arN3ZfxcNf4	Kids Find Fun	3:55	05/16	65,679	471	58
Who Is Considered A Close Contact https://www.youtube.com/watch?v=o-eIMcLBu88	Dearborn Public Schools	1:35	09/29	262	5	0
Help avoid Coronavirus (COVID-19) with These Tips https://www.youtube.com/watch?v=7tgm8KBlCtE	Baptist Memorial Health Care	1:00	03/21	91,219	694	34
Social distancing will help stop the spread https://www.youtube.com/watch?v=3btzdQ9nmiA	SA Health	0:15	03/23	467	N/A	N/A
Coronavirus and school https://www.youtube.com/watch?v=0iu5HamseAE	BAG OFSP UFSP	1:09	05/08	176,079	N/A	N/A
Why Do I Have To Wear a Face Mask? https://www.youtube.com/watch?v=vGB-hxst7fo	BayCare	2:01	08/07	169,983	821	214
How to wear a fabric mask safely https://www.youtube.com/watch?v=9Tv2BVN_WTk	World Health Organization (WHO)	2:09	06/17	757,524	5,568	340
How to protect yourself against COVID-19 https://www.youtube.com/watch?v=1APwq1df6Mw	World Health Organization (WHO)	1:30	02/28	4,964,659	98,828	2,365
Social Distancing EXPLAINED by KIDS! **UPDATE: 6 feet is advised. At time of filming it was 3 feet** https://www.youtube.com/watch?v=Ypm34dEGa2o	Kid Explorer	3:15	03/18	105,054	740	71
Coronavirus Outbreak | How to protect yourself | Kids Learning video https://www.youtube.com/watch?v=8H3IrXGyj08	Cooking with Mitisha	0:23	03/13	460	N/A	N/A
Mask Wearing: Cover Your Nose and Mouth https://www.youtube.com/watch?v=ckkz-u6pkE0	Nova Scotia Government	0:23	09/29	3,999	N/A	N/A
How to wear a fabric mask safely https://www.youtube.com/watch?v=9Tv2BVN_WTk	World Health Organization (WHO)	2:09	06/17	757,527	5,568	340
Kids & Masks: Wearing masks the right way to combat spread of COVID-19 https://www.youtube.com/watch?v=eBCw16FpvAM	University of Vermont Health Network	1:51	07/31	5,872	17	10
How To Wear A Mask In School https://www.youtube.com/watch?v=EC2OxVSX53M	Tech-nic-Allie Speaking	3:26	08/06	119,523	N/A	N/A

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
Coronavirus (Covid-19) Hygiene Etiquette for Kids https://www.youtube.com/watch?v=arN3ZfxcNf4	Kids Find Fun	3:55	05/16	65,679	471	58
Let's wear Face Masks! | Protect Your Children From Coronavirus (COVID-19) https://www.youtube.com/watch?v=SZPROzPNqDM	Hello Everything!	3:23	04/16	210,605	N/A	N/A
WEAR A MASK SONG FOR KIDS, SCHOOL, REMOTE LEARNING: Above Your Nose, Below Your Chin https://www.youtube.com/watch?v=xu8wYuZzF9Q	Classroom Learning Adventures	2:46	09/29	7,358	60	20
How to Safely Wear Your Mask https://www.youtube.com/watch?v=6Z9bd0vMZGU	mnhealth	1:00	07/15	10,270	11	8
Why Do People Wear Masks | Little Ones Version | Jack Hartmann https://www.youtube.com/watch?v=iE6L-4tO-rs	Jack Hartmann Kids Music Channel	2:20	06/15	386,022	2,135	288
Wear It Well: A Mask How-To for Kids https://www.youtube.com/watch?v=eGhLwmFRyZY	Manitoba Government	2:21	09/04	78,253	298	93
Wearing a Mask To School Social Story https://www.youtube.com/watch?v=ndW_NoE2f54	Carol Ploch	1:44	06/10	22,566	98	18
Do's and Don'ts for Wearing Face Masks https://www.youtube.com/watch?v=4MQieJVGSbE	San Angelo ISD	1:07	08/19	17,417	67	14
Healthy Habits while Social distancing | Let's learn Healthy Habits | Pinkfong Songs For Children https://www.youtube.com/watch?v=Wx2Q_8sSKXw	Pinkfong! Kids' Songs & Stories	2:21	06/15	2,584,142	15,306	8,069
What is personal protective equipment (PPE) (a video for children) https://www.youtube.com/watch?v=sNinywG7BtY	AboutKidsHealth	2:34	04/17	11,661	38	1
For Kids: Why Do I Have To Wear a Face Mask? https://www.youtube.com/watch?v=vGB-hxst7fo	BayCare	2:01	08/07	169,986	821	214
Wearing masks with COVID-19 https://www.youtube.com/watch?v=Rn7LhJeqYiI	DaVita Kidney Care	1:59	04/07	225,693	1,148	152
How to wear a mask at school https://www.youtube.com/watch?v=jayKBZFx_aw	CHEO	1:48	09/03	17,622	106	28
COVID-19 – Avoid Touching Eyes, Nose and Mouth https://www.youtube.com/watch?v=a3HB1bSaDAQ	MiamiDadeTV	0:13	03/12	3,209	N/A	N/A
You're Why We Wear Masks: Protect Others https://www.youtube.com/watch?v=mbYN1pMECJw	Duke Health	0:06	06/30	1,128	5	7

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
COVID Social Stories: "Cover Your Cough" (for young children) // Gemiini Systems https://www.youtube.com/watch?v=YtvkuyAdRp4	Gemiini Systems	0:33	08/25	1,553	N/A	N/A
COVID-19: Cover Coughs and Sneezes https://www.youtube.com/watch?v=Yr2odNBoUrQ	Children's Services Council of Palm Beach County	0:15	04/15	1,214	6	0
The Do's and Don'ts of Coughing, Sneezing, and Spitting https://www.youtube.com/watch?v=QDhFYPsewFY	Digital Medic at Stanford University	1:29	06/02	9,705	63	5
Washing your hands: The purple paint demonstration https://www.youtube.com/watch?v=nEzJ_QKjT14	Spartanburg Regional Healthcare System	0:59	03/24	4,143,712	89,634	7,124
COVID-19 – Cover your Cough or Sneeze https://www.youtube.com/watch?v=ygBuMeThfJU	MiamiDadeTV	0:12	03/12	1,200	N/A	N/A
Teach Kids to Cough and Sneeze Safely with Germ Puppets! https://www.youtube.com/watch?v=SHwop4Dx0dY	Boston Children's Museum	3:16	07/10	255	3	0
Cough and Sneeze Etiquette (Kids) COVID-19 Commercial https://www.youtube.com/watch?v=dGH9Q2SbEsg	Ministry of Health	0:43	04/06	2,171	6	0
How to Cover Coughs and Sneezes – Coronavirus Prevention Tip https://www.youtube.com/watch?v=mMzaiZ2n0cw	ej4	0:50	03/17	8,050	3	0
Coughing and Sneezing etiquette https://www.youtube.com/watch?v=dWPC0vyg8FY	KMG Videos	2:04	03/06	412	5	1
Stop the Spread of Germs and Cover Your Cough https://www.youtube.com/watch?v=mz9htbGb2nk	henrycomedcenter	0:15	04/06	122	0	0
5 Tips Kids Need to Know about Covid-19 https://www.youtube.com/watch?v=r4i4avKYOrw	Johns Hopkins Medicine	1:04	05/27	92,466	430	44
Sneezing and Coughing 101 https://www.youtube.com/watch?v=TZ9aIoUxDBg	American Public Health Association	0:53	03/11	30,183	48	2
Sneezing & Coughing Safely https://www.youtube.com/watch?v=BV005Zx7Dp8	Sesame Street In Communities	0:30	03/30	50,554	106	29
How Far Can a Sneeze Go? https://www.youtube.com/watch?v=ZoBslwE2luI	Science Buddies	1:24	04/01	7,575	12	1
Cover your cough! NMPBS Kids https://www.youtube.com/watch?v=zCDYFZMevXY	New Mexico PBS	0:10	03/18	237	2	0
How to for Kids: Cough and Sneeze into Your Elbow, Then Wash Your Hands! https://www.youtube.com/watch?v=VwaF4ssGPJ8	American Implement	4:10	03/27	883	10	1

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Table 9. *Continued from the previous page.*

Video title *Video URL*	*Producer/channel*	*Length*	*Date posted 2020*	*Views**	*Likes**	*Dislikes**
Cover Your Mouth When You Sneeze by Janice Robinson-Celeste | Illustrations by Arshaad Norwood https://www.youtube.com/watch?v=p82_7taarXA	Ethnic Animations	0:41	04/11	808	15	0
Cough, Cough, Sneeze, Sneeze https://www.youtube.com/watch?v=ntVplfuNp_8	Faith Lutheran Preschool	1:00	03/24	209	2	0
OFFICIAL SNEEZE COUGH HAND WASH, the Hygiene Song | Tiptoe Giants | Teaching Life Skills for Kids https://www.youtube.com/watch?v=bFtn0TGDm2Y	Tiptoe Giants	1:34	03/19	1,677	21	1
COVID-19 Update 3: Symptoms of COVID-19 [New Version in Description] https://www.youtube.com/watch?v=1PLdl6NDGDE	Medmastery	2:36	03/05	2,038,507	9,171	817
Coughing and Sneezing https://www.youtube.com/watch?v=uLbl8ybwmhw	Mary, Seat of Wisdom Montessori	0:32	04/24	168	3	0
Cover your nose and mouth when sneezing https://www.youtube.com/watch?v=Tv8SAFE5sec	KEEP Liberia	2:06	06/23	76	2	0
Sneezing Etiquette https://www.youtube.com/watch?v=P4D4wc-d9Vk	That TVOkids Show	0:44	03/17	2193	4	1
Cover your mouth when you sneeze or cough https://www.youtube.com/watch?v=MlCSJOkYpH8	Joyce –	0:42	04/18	27	0	0
Understanding COVID-19 and How to Stay Safe https://www.youtube.com/watch?v=DCdxsnRF1Fk	UpToDate	9:05	04/08	527,925	2,926	221
Safe Hands: Clean your hands with alcohol-based hand sanitizer https://www.youtube.com/watch?v=QD1nQa0zNMk	World Health Organization (WHO)	1:00	06/17	26,245	210	35
Tips for you and me to prevent COVID-19 (Transportation) https://www.youtube.com/watch?v=rVmxiI98pIk	CHP, Department of Health, HKSARG	0:30	05/15	127,779	25	5

* Data recorded within a 35-minute time period on 3/16/2021.
Some of this information and availability of videos may have changed since data was collected.
Number of comments was not recorded because the comment options is not available for most children's videos.

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Authors

Jocelyn Steinke is an associate professor in the Department of Communication at the University of Connecticut. E-mail: jocelyn.steinke@uconn.edu.

Carolyn A. Lin is a professor in the Department of Communication at the University of Connecticut. E-mail: carolyn.lin@uconn.edu.

Tamia Duncan received her master's degree from the School of Communication at Western Michigan University. E-mail: Tamia.Duncan@wmich.edu.

Viviana Zambrano is a doctoral student in the Department of Communication at the University of Connecticut. E-mail: vivianaczambrano@gmail.com.

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