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Review

Inclusive Crisis Communication in a Pandemic Context: A Rapid Review

Karin Hannes [1,2,*,†], Pieter Thyssen [1,2,3,†], Theresa Bengough [4], Shoba Dawson [5], Kristel Paque [6], Sarah Talboom [7], Krizia Tuand [8], Thomas Vandendriessche [8], Wessel van de Veerdonk [9], Daniëlle Wopereis [1] and Anne-Mieke Vandamme [2,3]

1 Research Group SoMeTHin'K, Centre for Sociological Research, Faculty of Social Sciences, KU Leuven, 3000 Leuven, Belgium; pieter.thyssen@uclouvain.be (P.T.); danielle.wopereis@viadonbosco.org (D.W.)
2 Institute for the Future, KU Leuven, 3000 Leuven, Belgium; annemie.vandamme@kuleuven.be
3 Department of Microbiology, Immunology and Transplantation, Rega Institute for Medical Research, Clinical and Epidemiological Virology, KU Leuven, 3000 Leuven, Belgium
4 Austrian National Public Health Institute, 1010 Vienna, Austria; theresa.bengough@goeg.at
5 School of Medicine and Population Health, University of Sheffield, Sheffield S1 4DA, UK; shoba.dawson@sheffield.ac.uk
6 Department of Nursing and Midwifery, University of Antwerp, 2000 Antwerpen, Belgium; kristel.paque@uantwerpen.be
7 Centre of Expertise—Sustainable Business and Digital Innovation, Campus De Ham, Thomas More University of Applied Sciences, 2800 Mechelen, Belgium; sarah.talboom@thomasmore.be
8 Learning Centre Désiré Collen, KU Leuven Libraries—Location: 2Bergen, KU Leuven, 3000 Leuven, Belgium; krizia.tuand@kuleuven.be (K.T.); thomas.vandendriessche@kuleuven.be (T.V.)
9 Centre of Expertise—Care and Well-Being, Campus Zandpoortvest, Thomas More University of Applied Sciences, 2800 Mechelen, Belgium
* Correspondence: karin.hannes@kuleuven.be
† These authors share the first authorship.

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Abstract: Background: Crisis communication might not reach non-native speakers or persons with low literacy levels, a low socio-economic status, and/or an auditory or visual impairments as easily as it would reach other citizens. The aim of this rapid review was to synthesize the evidence on strategies used to improve inclusive pandemic-related crisis communication in terms of form, channel, and outreach. **Methods:** After a comprehensive search and a rigorous screening and quality assessment exercise, twelve comparative studies were selected for inclusion in this review. Data were analyzed and represented by means of a structured reporting of available effects using narrative tables. **Results:** The findings indicate that a higher message frequency (on any channel) may lead to a lower recall rate, audio–visual productions and tailored messages prove to be valuable under certain conditions, and primary healthcare practitioners appear to be the most trusted source of information for most groups of citizens. Trust levels were higher for citizens who were notified in advance of potential exceptions to the rule in the effect of preventive and curative measures promoted. **Conclusions:** This review contributes to combatting information inequality by providing evidence on how to remove the sensorial, linguistic, cultural, and textual barriers experienced by minorities and other underserved target audiences in COVID-19-related governmental crisis communication in response to the societal, health-related costs of ineffective communication outreach.

Keywords: inclusive communication; crisis communication; pandemics; rapid review

1. Introduction

Access to information is not only a universal human right [1], but also key in combating a crises, such as the COVID-19 pandemic [2]. Yet, various signals indicate that current crisis communication does not reach all target groups equally. This was the case during the recent COVID-19 pandemic. Minority groups and people who experience sensorial,

linguistic, cultural, or textual barriers, in particular, were at risk of not accessing government communication [3]. Consequently, crisis communication might not reach non-native speakers or persons with low (health) literacy levels a low socio-economic status (SES), and/or an auditory or visual impairments as easily as it would reach other citizens. Indirectly, inefficient communication outreach increases the social- and health-related costs of the care system, e.g., through the late notification of an emergency situation or because of the mistrust of citizens regarding governmental strategies to solve healthcare problems effectively. This was particularly the case in low-literacy populations during the COVID-19 pandemic.

An inclusive crisis communication approach is successful when it does reach citizens of all abilities. This can be achieved by prioritizing the following four aspects of a crisis communication policy [2,4]: (1) accessible forms of communication (including (re)translations and media access services, such as subtitling, sign language, easy read, symbols, etc.), (2) accessible channels of communication (online or offline), (3) an efficient spread, and (4) effective outreach.

The aim of this rapid review was to synthesize evidence on the strategies used to improve inclusive pandemic-related crisis communication in terms of form, channel, and outreach. The project was initiated during the COVID-19 crisis. Ahl et al. [5] define crisis or risk communication as "the open two-way exchange of information and opinion about risk, leading to better understanding and better (clinical) decisions." We focused particularly on strategies that acknowledge the (multi)linguistic and sociocultural diversity, sensory limitations, and degree of literacy of the world population. We operationalized the term "inclusive" as the removal and overcoming of sensorial, linguistic, cultural, and textual barriers to access and absorb information in the wider context of the crisis communication process focusing on pandemics.

1.1. Pandemic Context

Crisis communication is event-specific and can happen before, during, or after an unexpected or unanticipated event or disaster [6]. With respect to natural disasters, a distinction can be made between biological natural disasters (e.g., epidemics and pandemics) and weather-related natural disasters (e.g., volcanic eruptions, floods, tsunamis, droughts, tornados, earthquakes, wildfires, landslides, etc.). They typically differ in scale, duration, and intensity. Weather-related natural disasters are generally limited in time and demand attention and action over a relatively short period of time [7]. Biological natural disasters, on the other hand, are long-lasting and require attention and action over much longer periods of time [8]. These differences also influence the emotional response and sensitivity of the population with respect to both types of natural disasters [6,9]. This project studies inclusive communication in the context of biological natural disasters, more specifically in a pandemic or epidemic context. Pandemics are characterized by the widespread outbreak of infectious diseases, which can spread rapidly across populations and geographical regions. This spread is influenced by various environmental factors, such as climate change, deforestation, urbanization, and wildlife–human interactions [10]. These factors can alter the habitats of pathogens and vectors, facilitating the transmission of diseases to humans [11]. Public health systems must therefore be prepared to detect, monitor, and respond to such outbreaks to prevent widespread morbidity and mortality. Other contexts requiring crisis communication, such as natural disasters, but also environmental or ecological disasters (e.g., oil spills, chemical waste dumps, the dioxin crisis, the Chernobyl 1986 and Fukushima 2011 nuclear meltdowns, etc.) and terrorism, were not taken into account for this rapid review.

1.2. Crisis Communication

Form, channel, and outreach are important preconditions for an inclusive crisis communication process. Such processes encompass additional elements that, while not the focus of this project, need to be taken into account as part of the crisis communication context. A first element is message content: what information is included in the message and how is it framed? A second element is behavior change. Some crisis communica-

tion messages are informative in nature; other messages aim to actively achieve behavior change—for instance, to convince people to take vaccines or to follow guidelines on safety measures. In this review, we focus on the short-term goals of accessibility and reach and how they is influenced by the roles of form, channel, and outreach potential in conveying a message.

Form refers to the different modalities the message content takes, i.e., written text, video, infographics, subtitling, translations, audio, and audio description (an additional narrative voice that provides information about relevant visual elements in a media work for people with visual impairments). Translation includes traditional interlingual translation from one language and culture into another, intralingual translation within the same language, and forms of intersemiotic translations (from one modality, e.g., written words, to another, e.g., spoken language or visuals).

Channel refers to the medium used to distribute the message and its different forms, including online and print channels. For example, printed folders, posters, television, radio, fixed phones, mobile phones, text messages and SMS, as well as internet-based resources, such as email, video conferencing, social media (WhatsApp, Facebook, Twitter, etc.), and (government) websites.

Outreach refers to the appropriateness of a message's form and channel for distribution to the target audience. This is a precondition to achieve wider access to information for the intended target groups, which indirectly supports a larger outreach and exposure in the long term.

1.3. Prioritized Target Groups

To achieve an inclusive approach in crisis communication, we paid attention to specific groups that are at risk of experiencing persisting barriers to access information and/or because they have a low socio-economic or literacy status. Different types of barriers considered in this review are:

Sensorial barriers: barriers to access the message content due to a permanent or temporary visual or auditory impairment, such as blindness, hearing loss, or deafness. For example, a hard-of-hearing person cannot access press conference videos without subtitling.

Linguistic barriers: barriers to access the message content due to linguistic accessibility problems. This includes low literacy skills and the level of language proficiency. For example, someone speaking a foreign language or not mastering the official language at a proficient level (i.e., language learners) may not understand a text's original language, no matter in which domain of society it is situated.

Cultural barriers: barriers to access the message content due to a different cultural background (e.g., different values and belief systems, behavioral patterns, and communication practices). Non-verbal textual aspects (such as the use of colors, images, symbols, reading order, body language, gestures, etc.) may differ from one cultural linguistic community to the next, and may influence how a message is accessed or received. For example, not identifying with the role models used in a video due to generational or cross-regional differences.

Textual barriers: barriers to access the message content due to the complexity and/or lack of clarity of the message. Both can constitute a potential barrier, particularly when a source text is used as a basis for translation for different audiences (=target text). If the source text is not clear, easy to understand, and quick to process without an extensive cognitive effort of the receiver, the message will not come across efficiently. In addition, if the source text is overly complex and/or unclear, its potential (re)translations will also remain unclear.

2. Why Is This Review Important?

In the event of a biological natural disaster, such as a pandemic or an epidemic, citizens actively seek information on how to act and deal with the imminent threat. What is more, as long as no treatments or vaccines are available, the control of a pandemic relies entirely on public health interventions, such as social distancing, contact tracing, mask wearing, and

lockdowns [12]. Public access to information—the availability and accessibility of timely, high-quality information—is therefore vital for combating the outbreak of an infectious disease and "flattening the curve". According to Koinig [13], the government plays a crucial role in managing a pandemic crisis by raising public awareness of the health threat and providing the population with targeted and timely information about the various containment and mitigation measures that are being imposed. Good crisis communication informs, instructs, and motivates; it builds trust for the authorities [14] and dispels rumors and misinformation. In addition, it empowers citizens in the sense that they know what to do to avoid and deal with infection. This requires intensive communicative efforts and effective communication strategies. Most importantly, these efforts and strategies should meet the specific communication needs of all populations to ensure that all societal groups are able to access, understand, and comprehend the information being communicated [15,16]. Indeed, as Hyland-Wood [17] observe, "there is no 'one size fits all' communications strategy to deliver information during a prolonged crisis". To fulfill the aims of inclusive crisis communication, all groups of citizens should be included and involved. The crisis communication should be targeted, designed, and adapted to their various needs. Recent studies on the topic of crisis communication during the COVID-19 pandemic have shown, however, that not all groups of citizens are reached equally [18,19]. There has been a disproportionate toll on vulnerable populations as most governments have failed to customize their crisis communication to these particular target groups. Some citizens have special needs and thus experience difficulties in accessing correct information, leading to an asymmetry of information where they might be less informed than others. This, in turn, can result in unequal disease prevention protection across society [16]. In what follows, we spell out what is already known from a variety of different study types on how to potentially remove sensorial, linguistic, cultural, and textual barriers. This rapid review further reports on the results from comparative study designs.

2.1. Removing Sensorial Barriers

One group that is particularly vulnerable in crisis times are people with disabilities. Previous studies have shown that it is much harder to reach out to and communicate with these people in crisis times [20,21]. This is only complicated by a general lack of knowledge amongst governments, authorities, municipalities, and companies about how to meet the needs of disabled people. As such, people with disabilities run a much higher risk of being disproportionately affected by a crisis [22]. For this rapid review, we focused on people with a permanent or temporary visual or auditory impairment, such as blindness, hearing loss, or deafness. We did not focus on people with a mental illness, neuropsychiatric disability, or mobility impairment, although similar disadvantages may be present in these groups as well. The American Association on Health and Disability (AAHD) conducted an online survey on COVID-19 and disability during the first wave of the pandemic [23]. The survey included a set of questions on the preferred channels for accessing information about the COVID-19 pandemic. Of the deaf and hard-of-hearing people, "34% [...] said the Internet was the most important source of information, followed by Television (26%) and Health Care Providers and Relatives (21%)". For persons with a visual impairment, "33% of respondents said the Television was the most important source of information, followed by the Internet (28%) and Radio (15%)". This is in line with another survey performed by Holloway [24] who observed that blind and visually impaired people in Australia accessed information about the COVID-19 pandemic mostly through television and radio news (with government and health institutions being the most popular sources of information). Naylor [25] studied the effects of the COVID-19 lockdown in Glasgow on people with hearing loss. They indicated that hard-of-hearing people experienced difficulties conversing with people wearing face masks due to muffled sounds and a lack of speech-reading cues. Naylor et al. [25] therefore suggested the adoption of transparent face masks to alleviate some of the communicative difficulties experienced by this population. The same suggestion was made by Mörchen, Kapoor, and Varughese [26] in a study on

communication with visually impaired people and eye health patients during the pandemic. Although people with hearing loss did not experience major obstacles when following TV and radio updates about the evolving pandemic, Naylor et al. [25] nevertheless suggested the use of live subtitles on video calls. This suggests that much can be learned from studying the tactics and strategies proposed by the target group for conveying messages in a pandemic context.

2.2. Removing Linguistic Barriers

Another group that faces considerable challenges in crisis times are foreign language speakers. In our super-diverse societies, foreign language speakers and language learners may not always master the local official language(s) at a sufficiently high proficiency level to understand the government's crisis communication messages. Multilingual crisis communication (i.e., the translation of crisis communication messages into various languages) is therefore an important prerequisite to bridge these language barriers and to ensure that the entire population of a country is reached. Although the role and importance of language translation and multilingual crisis communication in multilingual and multicultural societies has been highlighted before [27], it remained underestimated, if not unrecognized during the COVID-19 pandemic. In a recent study, which aimed at assessing the inclusion of individuals with a migrant background in COVID-19 prevention measures, Maldonado [28] investigated whether governmental risk communications were available in common migrant languages across Europe. They identified clear gaps in the availability of translated COVID-19 risk communications across Europe, excluding migrants from receiving the necessary information in their own languages. Chen [29] explored the availability of multilingual public health messages against the spread of COVID-19 in Taiwan between January and April 2020, with similar results. Also, indigenous populations faced significant language barriers, and were thus excluded from most public health communications. The identified reasons for this include the dominance of English-centric global mass communication, the longstanding devaluation of minoritized languages, and the failure to consider the importance of multilingual repertoires for building trust and resilient communities [30].

2.3. Removing Cultural Barriers

Different strategies have been developed for optimal crisis communication in a culturally diverse society [31]. This could involve the use of different channels and communication platforms, differences in the speed of speaking, eye contact with the audience, facial expressions, and differences in tone of voice (e.g., an empathetic, compassionate, or supportive tone versus a serious, clinical, or reserved tone). Wertz and Kim [32], for example, observed that the Korean government uses a more aggressive message strategy than the US government in times of crisis. Similar differences were observed by Low [33] between the communication strategies of Western and Asian governments. According to Oliveira [34], culturally adjusted crisis strategies are not yet sufficiently adopted. Failure to consider cultural factors may lead to offensive feelings, misunderstandings, criticism, and an unwillingness to follow the various mitigation and containment measures.

2.4. Removing Textual Barriers

A good strategy to remove textual barriers is the use of plain language or easy-to-read language. Plain language (also called plain writing or plain English) is a style of writing that is easier to read, understand, and use, compared to normal language, as it avoids verbose, convoluted language and jargon. It is used to reach all audiences. Easy-to-read language on the other hand is specifically designed to meet the needs of people with cognitive and learning disabilities, as well as language learners or people with low literacy levels. But also migrants, people with severe social problems, or the elderly can benefit from easy-to-read language [35]. The World Health Organization (WHO) observes that, if people have to read a "message several times to understand it, they are not likely to act on the advice and guidance in the message" [36]. To that aim, the WHO has suggested (1) to organize

information so the most important points come first, (2) to create a single overarching communication outcome (SOCO) that defines the desired outcome, for example, behavior change, (3) to break long and complicated information into understandable portions, (4) to use simple language to explain the meaning of technical terms, and (5) to format documents with plenty of white space so they are easy to read. Although it has become standard practice to translate crisis communication messages into plain or easy-to-read language, very little research has been performed on the readability of COVID-19 crisis communication messages. One exception is Basch [37] who assessed the readability of information posted on the Internet about the COVID-19 pandemic. Multiple readability tests were conducted on 100 different English language websites, including the Coleman–Liau Index (CLI), the Gunning Fog Index (GFI), the Simple Measure of Gobbledygook (SMOG) Grade Level, the Flesch–Kincaid Grade Level (FKGL), and the Flesch–Kincaid Reading Ease (FRE). To have a maximum impact, crisis communication messages should be readable at the 6th-grade reading level [38]. Four of the five measures (CLI, GFI, SMOG, and FRE) found that readability on these websites exceeded the 10th-grade reading level, indicating that these texts would be difficult to read for the average American.

3. Objectives and Review Question

To reach all groups equally, inclusive crisis communication strategies are needed, which focus on removing or responding to various sensorial, linguistic, cultural, and/or textual barriers. The Emergency Risk Communication Model by Seeger [39] highlights optimal accessibility and exposure as necessary conditions to achieve the longer-term goal of behavior change (i.e., the willingness to be tested and/or vaccinated, or to follow the various containment and mitigation measures that are imposed). In this rapid review, we focus on the short-term goals. The review question is as follows:

For persons with sensorial, linguistic, cultural, and/or textual barriers, which communicate interventions on the level of the form, channel, and outreach in crisis communication messages are the most effective and applicable in an epidemic or pandemic context, from a comparative perspective?

4. Methods

4.1. Design

For this rapid review, we followed the principles and guidelines in the WHO Practical Guide on Rapid Reviews to Strengthen Health Policy and Systems [40]. The rapid review protocol consists of several steps in two different review phases. In the first phase, relevant papers published until 17 May 2021 were retrieved from 7 major electronic databases, screened, and assessed for quality. The first phase resulted in 9796 retrieved studies. After the removal of duplicates, systematic reviews, and meta-analyses, 5825 studies were eligible for screening. However, since the first phase resulted in a very limited number of relevant papers, considering the increased popularity of crisis communication as a topic during the current global pandemic, a rapid review update was initiated during the project time in an attempt to find additional sources at a later stage (phase 2). In phase 2, we retrieved, screened, and assessed papers that were published between 17 May and 15 October 2021. We retrieved 2507 new studies published after 17 May 2021. After the removal of duplicates, systematic reviews, and meta-analyses, 1675 studies remained for screening. We followed the same methodological strategy for both phases (outlined in Figure 1).

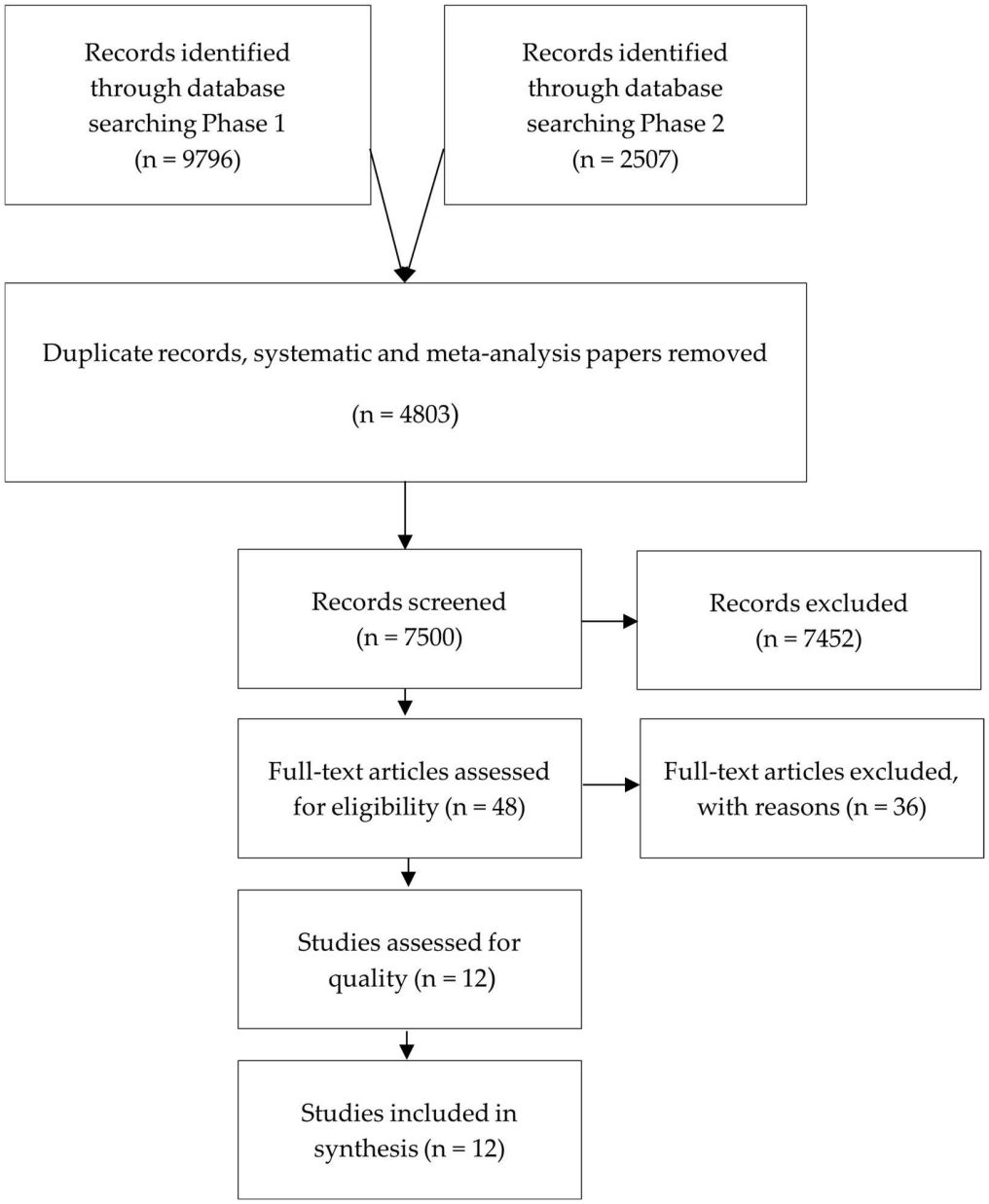

Figure 1. Outline of included and excluded studies.

4.2. Inclusion Criteria

Population of interest: Priority was given to evidence that was relevant to people in the following situations: (a) foreign language speakers and/or (b) citizens with low literacy skills and/or (c) citizens with a low SES and/or (d) citizens with an auditory or visual impairment.

Intervention of interest: Priority was given to communicative interventions on the level of the form, channel, and outreach capacity in crisis communication. Studies focusing on the content of the message were excluded.

Comparison: Priority was given to standard crisis communication, or other interventions in relation to form (e.g., subtitles versus voiceover and static versus dynamic pictorial language), channel (e.g., online versus print) or outreach, or no communication at all. Only comparative study designs were taken into account, e.g., evaluation studies, clinical, intervention, observational, comparative, before and after, and preventive studies, as well as RCTs, quasi-RCTs, and other types of controlled studies. Non-comparative and

qualitative studies, dissertations, conference papers, books, editorials, and opinion pieces were excluded.

Outcome of interest: Priority was given to inclusive crisis communication markers, such as accessibility and exposure. Accessibility refers to the ideal situation in which all sensorial, cognitive, linguistic, and cultural barriers have been overcome. Exposure refers to the situation in which the actual outreach potential of the communication strategy has been achieved in the target group. Studies focusing on behavior change as an outcome were excluded (as this is a long-term goal).

Context of interest: This rapid review was written in the context of pandemic or epidemic crisis situations. The World Health Organization [41] has identified numerous infectious diseases that have the potential to become international threats. Based on their work, we compiled an initial list of 23 pandemic or epidemic diseases. We subsequently removed all zoonotic diseases. No distinctions were made on the basis of the pathogen (e.g., virus or bacterium) or whether the disease is spread via saliva or aerosols. This resulted in a final list of 12 pandemic or epidemic disease contexts we focused on: Ebola Virus Disease, Lassa Fever, Avian Flu, Influenza, Seasonal Influenza, Pandemic Influenza, Middle East Respiratory Syndrome (MERS), Meningococcal Meningitis, Hendra Virus Infection, Nipah Virus Infection, Novel Coronavirus (2019-nCoV), Severe Acute Respiratory Syndrome (SARS), and Smallpox.

4.3. Search Strategy and Study Retrieval

We searched 7 major electronic bibliographic databases for relevant papers: CINAHL (EBSCO), Web of Science Core Collection (including the ISI Social Science Index and Arts and Humanities Index), Medline/PubMed, Embase, ERIC (OVID), Cochrane CENTRAL, and Cochrane CDSR. The search strategy was developed in collaboration with three biomedical reference librarians from the KU Leuven Libraries—Location: 2Bergen—learning Centre Désiré Collen (Leuven, Belgium). The full search strategy and complete list of search terms applied to Medline/PubMed can be found in the annex (see Appendix A). We used four parameters to build our search strategy. The first search string thus consisted of all terms that capture the epidemic and/or pandemic context. The second and third search strings included terms that characterize interventions in crisis communication (Phenomenon) and the topical areas Channel and Form. The fourth search string represented the study designs under review. The search strings were adapted for use in the other databases. For each of the four parameters, we looked for specific Medical Subject Heading (MeSH) terms, synonyms, and related terms. This rapid review included two phases of study identification, which allowed us to include additional studies produced during or in response to the ongoing COVID-19 crisis situation. The search results from included databases were exported and merged into the citation management software EndNote (version X9), yielding a total of 9796 retrieved studies for phase 1 (up to 17 May 2021) and 2507 studies for phase 2 (from 18 May to 15 October 2021). We sorted the retrieved findings. After the removal of 3049 duplicates, an additional 1754 review projects and meta-analyses were removed. This left us with 7500 unique studies across both phases.

We only considered studies written in the English language, mainly because new evidence illustrates that including additional, non-English literature does not seem to change the conclusions to a large extent [42]. Nussbaumer-Streit, in her methodological review, states that non-English publications are not always the main publication (and usually of a smaller scale) and/or do not seem to alter the size or direction of an effect measured to a large extent. Their exclusion was therefore promoted as a viable methodological shortcut in the context of rapid reviews. Studies had to be full-length articles or papers that were peer-reviewed. Studies were initially considered fitting when they focused on foreign language speakers and/or people with low literacy skills, and/or people with low SES and/or people with an auditory or visual impairment. During the first scoping and screening phase of the included papers, we noticed that only a low number of comparative studies focused on the included target groups. We therefore revisited the inclusion criterion

"population of interest". Studies that did not focus on these specific target groups but met all other criteria were picked up and considered as indirect evidence to inform practice and policy. It was decided to highlight potential extrapolation issues from one population to another as part of the findings and Discussion Section.

We followed the best practices guidelines for abstract screening, as outlined by Polanin et al. [43], and used Rayyan, a web and mobile screening app for systematic reviews [44], to facilitate screening. In order to avoid random and/or systematic errors in the study selection, and in order to ensure that the above eligibility criteria were applied consistently, a double-screening approach was adopted for a subset of the studies. We opted for an approach in which 20% of all papers was double-screened and interrater agreement rates were calculated. The interrater agreement (also known as percent agreement) is defined as the degree to which scores/ratings between reviewers looking at the same abstract are identical [45]. In judging the outcome of the interrater agreement, we made a distinction between major and minor conflicts. A major conflict occurs when screener A has included a study, whereas screener B has excluded the study. A minor conflict occurs when screener A has either included or excluded a study, whereas screener B remains undecided (by answering "maybe"). In our case, individual agreement rates varied between 88% and 100% for phase 1 (first batch of studies retrieved), with an average group agreement of 96%. This bolstered our confidence in the individual screening results. In addition, the majority of conflicts was minor conflicts (67% to be precise, and up to 88% if the conflicts with screener 8 out of 14 screeners were ignored). The deviant results of screener 8 were related to the incapability of assessing the study design criterion. A total of 17 major and 32 minor conflicts was observed. In phase 2, we reached an agreement rate of 95%, with only minor conflicts. In both cases, discrepancies were resolved by a third, experienced reviewer.

4.4. Quality Appraisal

Four independent reviewers screened the full texts of the 26 (phase 1) and 22 (phase 2) remaining studies to further identify the eligibility of the articles (see Appendix B, Tables A1 and A2).

The quality of the studies was simultaneously assessed. Given the broad variety in comparative designs encountered, only two quality aspects were considered: (1) Is the basic study design valid for comparative purposes? And (2) is the study methodologically sound? (in the sense of being executed according to the state of the art for a particular design). Disagreements between two reviewers were resolved by discussion and consensus. A total of 21 studies (phase 1) and 15 studies (phase 2) eventually did not meet the eligibility criteria when considering the full text. Most were excluded due to wrong study design (non-comparative/non-evaluative), although many also lacked a correct topic, focus, context, or population. In the end, only 12 studies (5 for phase 1 and 7 for phase 2) were deemed eligible. All of these met the two listed basic parameters of quality.

4.5. Analytical Approach

Because of the topical and methodological diversity displayed in the studies, we opted for a structured reporting of available effects using narrative tables [46]. For each eligible study, a summary sheet was made. The summary sheet included information on the author, year and country, study design, sender and receiver (i.e., population) of the crisis communication messages, intervention, control, and outcome of the scientific evidence, and were deemed necessary, concluding remarks. A final column with remarks from the reviewers provided specific information to readers that might help facilitate their assessment of the relevance of the study for their particular local context and target group. Results were aggregated in a narrative storyline on the effectiveness of form, channel, and sender.

5. Results

A total of 12 studies was included in this review (Box 1).

We briefly summarize the findings of the 12 included studies with regard to the effectiveness and applicability of different crisis communication strategies that target the inclusion of these vulnerable and minority groups (see also the summary sheets in Appendix C, Tables A3–A15). We evaluated the impact of form, channel, and sender in crisis communication on three different outcomes: spread, reach, and awareness levels of citizens. More specifically, we focus on those citizens experiencing sensorial, linguistic, cultural, and/or textual barriers.

5.1. Effectiveness of Form

In terms of form specifications, several authors suggest that video messages increase knowledge about crisis situations and the measures to be taken [47–49]. However, certain forms have a greater effect than others. Bekalu et al. [50] indicate that non-narrative, didactic messages convey information in a health crisis better than messages in a narrative form. However, the study findings need to be read with caution as the direction of the effect may have been influenced by factors such as the choice of the narrative clip included in the study (e.g., a film clip that was not well understood). Mistree et al. [47] argue that videos with concept explanations significantly increase pandemic knowledge compared to videos that only provide facts. This is in line with the findings from Lee's and Jahng's [51] study in which the effect of storytelling on levels of trust, perception of crisis responsibility, and persuasion has been judged as positive. Longer videos of approximately 20 min score better in terms of increasing knowledge compared to shorter ones. A side note to this finding is that this effect largely depends on the length of the average attention span of the public or context for which the video is made [47]. We also found evidence for the effectiveness of wordless, animated videos [49]. This is promising for an outreach to people with linguistic or textual barriers. An important positive side effect of using infographics displaying a particular image of scientists is that depicting them as a normal person slightly increases the believability in the narrative brought [52]. The result was not significant though.

Box 1. Final list of included studies in alphabetical order [47–50,52–59].

*Agley, J., Xiao, Y., Thompson, E. E., & Golzarri-Arroyo, L. (2021). Using infographics to improve trust in science: a randomized pilot test. BMC research notes, 14(1), 1–6.
*Bahety, G., Bauhoff, S., Patel, D., & Potter, J. (2021). Texts Don't Nudge: An Adaptive Trial to Prevent the Spread of COVID-19 in India.
*Baseman, J. G., Revere, D., Painter, I., Toyoji, M., Thiede, H., & Duchin, J. (2013). Public health communications and alert fatigue. BMC health services research, 13, 295.
*Baseman J., Revere D., Painter I., Oberle M., Duchin J., Thiede H., Nett R., *MacEachern D., Stergachis A. (2015) A Randomized Controlled Trial of the Effectiveness of Traditional and Mobile Public Health Communications With Health Care Providers. Disaster Med Public Health Prep. Feb, 10(1), 98–107.
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*Johnson, B. B., & Slovic, P. (2015). Fearing or fearsome Ebola communication? Keeping the public in the dark about possible post-21-day symptoms and infectiousness could backfire. Health, Risk and Society, 17(5), 458–471.
*Mistree, D., Loyalka, P., Fairlie, R., Bhuradia, A., Angrish, M., Lin, J., ... & Bayat, V. (2021). Instructional interventions for improving COVID-19 knowledge, attitudes, behaviors: Evidence from a large-scale RCT in India. Social Science & Medicine, 276, 113846.
*Okuhara T., Okada H., Kiuchi T. (2020). Examining persuasive message type to encourage staying at home during the COVID-19 pandemic and social lockdown: A randomized controlled study in Japan. Patient Education and Counseling 103(12), 2588–93. https://dx.doi.org/10.1016/j.pec.2020.08.016
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In addition, evaluating the impact of open and proactive communication in crisis situations was within reach of this review. We retrieved a study from Johnson et al. [53] emphasizing the importance of communicating in advance, the reason behind a particular measure when it is implemented. In case of an exceptional situation (such as symptoms of disease occurring after a quarantine period), it is advisable to mention it up front and to communicate why a certain measure (in this case, the length of a quarantine period) was chosen. Informing people in advance about possible exceptional situations that might occur increased the trust levels of citizens in health experts and institutes. Explaining the reason behind measures taken in response to these exceptions also had a positive effect on the trust levels of citizens. Trust levels were lower in the comparative group that spontaneously encountered these exceptions.

5.2. Effectiveness of Channel

In terms of channel specifications (i.e., which medium is used to disseminate information), Baseman et al. [54] suggest that messages sent by email generate higher recall rates than messages sent by other means, such as fax or SMS. The scientific evidence, however, is not entirely unequivocal. If one only considers the situations where the messages are actually received (as compared to the situations where messages are sent out but fail to reach the receiver), the recall rates for email and fax are identical (48.3%). Overall, the lowest recall occurs for messages sent via SMS.

In terms of the effectiveness of message frequency and timing, the evidence suggests that a higher message frequency (on any channel) may lead to a lower recall rate [55]. Bahety et al. [56] further suggest that timing makes a difference: when messages are sent too late (long after an outbreak) and without much visual support, they might lose their effect.

5.3. Effectiveness of Sender

We also looked at the effect of using different senders to disseminate relevant health information in a crisis situation, with a particular focus on pandemics and epidemics. Evidence suggests that medical doctors are best placed to deliver such information, as they increase the willingness of citizens and patients to adhere to advice [57]. In some cases, though, other senders appear to be more effective. For example, respondents who received an emergency message from a COVID-19 patient or a resident of a COVID-19 outbreak area felt more vulnerable to the virus than respondents who received an emergency message from a doctor. Overall, citizens seem to trust information from senders whose identity or institute can be verified better [58]. It also positively influences people's search intent. Messages tailored to religious, economic, or other specific identities also increase the motivation to follow measures [59]. Yet, investigations studying the impact of skin color or differences in the ethnic profiling of senders, such as doctors, do not suggest any beneficial effect on knowledge increase [48].

6. Discussion

In this review, we described the findings of existing research on inclusive crisis communication, informed by the literature from cognitive and social psychology, sociology, health sciences, and applied forms of crisis communication. This rapid review was set up from an inclusivity perspective. People's engagement with and response to public health information and messaging appears to be influenced by their cultural and social identity, age, gender, and access to resources [17]. In addition, there is great individual variation in the needs of people living in challenging circumstances. We focused on crisis communication for a specific proportion of underserved target groups in pandemic or epidemic conditions. Specific attention was paid to the needs of people living in challenging circumstances and/or minority groups who experienced sensorial, linguistic, cultural, or textual barriers, i.e., non-native speakers, people with low literacy skills, people with low SES, and people with sensory (auditory or visual) impairments.

The COVID-19 pandemic has been an important catalyst for recent scholarly work on how to render crisis communication accessible to all, outlining various strategies, policies, and recommendations, tailored to diverse audiences. However, both the state of the art and the results from this rapid review testify to a general lack of high-quality academic research on the topic of inclusive crisis communication. Indeed, of the 7500 retrieved original studies, only 12 studies made it through the entire screening process and quality appraisal. This is indicative of an important gap in the literature for high-quality, comparative study designs on the topic of inclusive crisis communication that needs to be tackled in future research. This gap may also help explain why (inter)nationally validated policy guidelines on inclusive crisis communication hardly exist to support governments in reaching the goals of inclusivity. The fact that many researchers were conducting experimental and comparative studies in the midst of the COVID-19 pandemic, with the request to deliver fast results, may have contributed to the low-quality level detected in the full study pool and the overall lack of robust evidence from high-quality randomized controlled studies.

Another reason for the initially very-small sample of included studies was our specific focus on a population of non-native speakers, people with low literacy skills, people with low SES, and people with auditory or visual impairments. Many potentially relevant studies targeting citizens more generally were initially excluded on the basis of a wrong population, but picked up again in a later phase of the review to increase the number of studies that can provide relevant information to end-users, for example guideline developers. Using a selective sampling procedure, we reselected studies that were excluded for population purposes (read: studies that did not focus on the vulnerable populations as specified in our inclusion criteria). Despite the fact that the conclusions from these studies only provide indirect evidence, it allows interested end-users to investigate the possibility of extrapolating insights from one population to another in their particular decision-making context. Working on review projects in crisis situations where evidence is generated based on progressive insight requires a substantial amount of flexibility and where an adaptation of predefined criteria is needed that might only work in ideal circumstances, but not necessarily for the context for which rapid systematic reviews need to be developed.

Given the importance of communication in a public healthcare context and the high economic and social costs of ineffective communication strategies, Dreisbach and Mendoza-Dreisbach [60] plead for a new field in linguistics to tackle public health translation in emergencies: emergency linguistics. In response to the current lack of multilingual crisis communication, several recommendations have been proposed. Maldonado et al. [28] recommend working with non-governmental organizations (NGOs) and migrant community groups. O'Brien et al. [61] concur that one should "establish strategic partnerships with relevant not-for-profit organisations in advance of crises so that communities are more likely to receive crucial information more rapidly and that they might have a higher level of trust in that information".

7. Conclusions

The findings of this rapid review are meant to support researchers that take the (multi)linguistic and sociocultural diversity or degree of literacy of citizens into account in their work. Specifically, this review contributes to combatting information inequality by providing evidence on how to remove the sensorial, linguistic, cultural, and textual barriers experienced by minorities and other harder-to-reach target audiences in COVID-19 related governmental crisis communication. Our findings highlight the importance of form, channel, and sender in crisis communications in order to be inclusive and to reach underserved audiences. Although the content of a message may remain stable, content creators should reflect on which type of person (sender) is perceived as the most trustworthy by people in particular minority groups. They should also pay attention to the clarity, length, and accessibility of the content (form). The latter might require more contextual information regarding messaging for those with hearing or visual impairments, as their exposure to different types of information providing such content might be more

limited. Frequency of electronic messaging (channel) should be modest, and the timing should be right to reach the intended audience. To conclude, cultural sensitivity generally is appreciated by many of the populations under study in this review [16]. These populations can be perceived as a critical case to support decisions on the best possible strategy for crisis communication: when it works for those who encounter (multiple) barriers, it will surely work for a more general population of citizens.

Author Contributions: This transdisciplinary author team was compiled of content experts from the field of social science research, KU Leuven (D.W. and K.H.), virology (A.-M.V. and P.T.), and social inclusion (S.D. and K.H.). It builds on the methodological skills of experts in search and screening strategies (K.P., K.T. and T.V.), applied sciences (S.T. and W.v.d.V.), systematic review methodology (T.B., S.D. and K.H.), and evidence-based policy (T.B. and S.D.). All authors have read and agreed to the published version of the manuscript.

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Appendix A. PubMed Search Strategy (Version 10)

Concept 1: epidemic/pandemic context

"Disease Outbreaks" [Mesh] OR outbreak*[tiab] OR epidemic*[tiab] OR epidemy[tiab] OR pandemy[tiab] OR pandemic*[tiab] OR crisis[tiab] OR crises[tiab] OR "Hemorrhagic Fever, Ebola" [Mesh] OR ebola[tiab] OR ebolavirus*[tiab] OR "Ebolavirus" [Mesh] OR ebola-like[tiab] OR "Lassa Fever"[Mesh] OR lassa[tiab] OR "Lassa virus"[Mesh] OR "Orthomyxoviridae Infections" [Mesh] OR Orthomyxovir*[tiab] OR influenza*[tiab] OR flu[tiab] OR flue[tiab] OR flus[tiab] OR "fowl plague" [tiab] OR grippe[tiab] OR "Influenza Pandemic, 1918–1919" [Mesh] OR "Influenzavirus A" [Mesh] OR influenzavirus*[tiab] OR H10N7[tiab] OR H10N8[tiab] OR H1N1[tiab] OR H1N2[tiab] OR H2N2[tiab] OR H3N2[tiab] OR H3N8[tiab] OR H5N1[tiab] OR H5N2[tiab] OR H5N8[tiab] OR H7N1[tiab] OR H7N2[tiab] OR H7N3[tiab] OR H7N7[tiab] OR H7N9[tiab] OR H9N2[tiab] OR "Influenzavirus B"[Mesh] OR "Influenzavirus C" [Mesh] OR "Coronavirus Infections" [Mesh] OR "middle east respiratory syndrome" [tiab] OR MERS[tiab] OR "Middle East Respiratory Syndrome Coronavirus" [Mesh] OR "Middle East respiratory syndrome-related" [tiab] OR "MERS-CoV" [tiab] OR "Meningitis, Meningococcal" [Mesh] OR "Meningococcal Meningitis"[tiab] OR "Waterhouse Friderichsen Syndrome" [tiab] OR "Purpura Fulminans"[tiab] OR "Waterhouse-Friederichsen Syndrome" [tiab] OR "Waterhouse Friederichsen Syndrome" [tiab] OR "Fulminant Meningococcal Sepsis with Adrenal Apoplexy" [tiab] OR "Meningococcal Hemorrhagic Adrenalitis" [tiab] OR "Neisseria meningitidis" [Mesh] OR "Neisseria meningitidis" [tiab] OR "Neisseria weichselbaumii" [tiab] OR "Diplokokkus intracellularis meningitidis" [tiab] OR "Micrococcus meningitidis" [tiab] OR "Meningococcus" [tiab] OR "Micrococcus intracellularis" [tiab] OR "Micrococcus meningitidis cerebrospinalis" [tiab] OR "serogroup A" [tiab] OR "serogroup B" [tiab] OR "serogroup C"[tiab] OR "serogroup W*" [tiab] OR "serogroup Y"[tiab] OR "serogroup X"[tiab] OR "epidemic meningitis" [tiab] OR "epidemic cerebrospinal meningitis" [tiab] OR "Henipavirus Infections" [Mesh] OR henipavirus*[tiab] OR henipa[tiab] OR hendra[tiab] OR nipah[tiab] OR NIV[tiab] OR "Hendra Virus" [Mesh] OR "Equine Morbillivirus*" [tiab] OR hendravirus*[tiab] OR "Nipah Virus" [Mesh] OR nipahvirus[tiab] OR ("Coronavirus" [Mesh:NoExp] OR "Betacoronavirus" [Mesh:NoExp] OR

"Coronavirus Infections" [Mesh:NoExp] OR "COVID-19"[MeSH] OR nCoV[tiab] OR 2019nCoV[tiab] OR COVID[tiab] OR COVID19[tiab] OR nCoV[ad] OR 2019nCoV[ad] OR Covid[ad] OR COVID19[ad] OR "SARS-Cov-2"[MeSH] OR SARS2[ad] OR "cov 2" [ad] OR cov2[ad] OR coronavirus*[ad] OR "corona virus*" [ad] OR SARS2[tiab] OR "cov 2"[tiab] OR cov2[tiab] OR coronavirus*[tiab] OR "corona virus*" [tiab] OR "Wuhan virus"[tiab] OR ((wuhan[tiab] OR novel[tiab] OR new[tiab] OR 19[tiab] OR 2019[tiab] OR epidem*[tiab] OR pandem*[tiab] OR outbreak[tiab] OR wuhan[ad] OR novel[ad] OR new[ad] OR 19[ad] OR 2019[ad] OR epidemy[ad] OR epidemic*[ad] OR pandem*[ad] OR outbreak[ad]) AND ("pneumonia virus*" [tiab] OR cov[tiab] OR hcov[tiab]))) OR "Severe Acute Respiratory Syndrome" [Mesh] OR SARS[tiab] OR "Severe Acute Respiratory Syndrome" [tiab] OR "SARS Virus"[Mesh] OR "SARS-Related"[tiab] OR SARS-CoV[tiab] OR "SARS-Associated" [tiab] OR "sudden acute respiratory syndrome"[tiab] OR "hcov-SARS" [tiab] OR "Smallpox" [Mesh] OR smallpox[tiab] OR variola*[tiab] OR alastrim[tiab] OR "Variola virus" [Mesh] OR "small pox" [tiab]

Concept 2: (crisis) communication

"Communication" [Mesh:NoExp] OR "communicat*" [tiab] OR "public warning*" [tiab] OR "Health Communication" [Mesh] OR "Health Promotion"[Mesh:NoExp] OR "health promotion*" [tiab] OR "campaign*" [tiab] OR "message strateg*" [tiab] OR "Preventive Health Services" [Mesh:NoExp] OR "preventive health"[tiab] OR "preventive program*" [tiab] OR "preventive service*" [tiab] OR "Immunization Programs"[Mesh:NoExp] OR "immunization program*"[tiab] OR "immunisation program*" [tiab] OR "vaccination promotion" [tiab] OR "vaccination awareness*"[tiab] OR "Vaccination Coverage" [Mesh] OR "Vaccination Coverage*"[tiab] OR "immunization coverage*" [tiab] OR "immunisation coverage*" [tiab] OR "head start program*" [tiab] OR "Consumer Health Information" [Mesh] OR "health information" [tiab] OR "medical information"[tiab] OR "Information Services" [Mesh:NoExp] OR "information service*" [tiab] OR "Information Dissemination" [Mesh] OR "Information Dissemination" [tiab] OR "Information Distribution" [tiab] OR "Information sharing*" [tiab] OR "risk presentation*" [tiab] OR "risk representation*" [tiab] OR "risk format*" [tiab] OR "risk reduction format*" [tiab] OR "presenting risk*" [tiab] OR "presenting information" [tiab]

Concept 3: channels and forms

"Information Dissemination"[Mesh] OR "Information Dissemination" [tiab] OR "Information Distribution" [tiab] OR "Information sharing*" [tiab] OR "risk presentation*" [tiab] OR "risk representation*" [tiab] OR "risk format*" [tiab] OR "risk reduction format*" [tiab] OR "presenting risk*" [tiab] OR "presenting information" [tiab] OR "intermediary" [tiab] OR "psycholinguistic*" [tiab] OR "sociolinguistic*" OR"Communications Media" [Mesh:NoExp] OR "mass communicati*" [tiab] OR "answering service*" [tiab] OR "Blogging"[Mesh] OR "blog" [tiab] OR "blogs"[tiab] OR "blogging"[tiab] OR hotline*[tiab] OR "influencer*" [tiab] OR "role model*" [tiab] OR "Mass Media" [Mesh:NoExp] OR "mass media" [tiab] OR "folk media" [tiab] OR "printed media" [tiab] OR "broadcast*" [tiab] OR "Radio" [Mesh] OR "radio" [tiab] OR "radios" [tiab] OR "Television" [Mesh:NoExp] OR television*[tiab] OR "Motion Pictures" [Mesh] OR "motion picture*" [tiab] OR film*[tiab] OR cinema*[tiab] OR movie*[tiab] OR "Pamphlets" [Mesh] OR pamphlet*[tiab] OR brochure*[tiab] OR booklet*[tiab] OR "bulletin*" [tiab] OR "leaflet*" [tiab] OR "news medi*" [tiab] OR "Newspapers as Topic" [Mesh] OR newspaper*[tiab] OR "Periodicals as Topic" [Mesh] OR periodical[tiab] OR periodicals[tiab] OR magazine*[tiab] OR journal*[tiab] OR newsletter*[tiab] OR "Public Service Announcements as Topic" [Mesh] OR "public service announcement*"[tiab] OR "public service ad*" [tiab] OR "public services ad*" [tiab] OR "service message*"[tiab] OR "public health message*" [tiab] OR "public health ad*" [tiab] OR "public health announcement*"[tiab] OR "promotion message*" [tiab] OR "service announcement*" [tiab] OR "service message*" [tiab] OR "Government Publications as Topic" [Mesh] OR "government publication*" [tiab] OR "Translations" [Mesh] OR translation[tiab] OR translations[tiab] OR retranslation*[tiab] OR translating*[tiab] OR "Social Networking" [Mesh:NoExp] OR "Online Social Networking" [Mesh] OR "Social Media" [Mesh] OR "social medi*" [tiab] OR "social network*" [tiab] OR "online communication" [tiab] OR twitter[tiab] OR facebook[tiab] OR instagram[tiab] OR "youtube"[tiab] OR avatar*[tiab] OR hashtag*[tiab] OR whatsapp[tiab] OR "postal mail*" [tiab] OR "postal deliver*" [tiab] OR "postal service*" [tiab] OR propaganda[tiab] OR "publicity" [tiab] OR "Teaching Materials" [Mesh:NoExp] OR "teaching material*"[tiab] OR "instructional material*" [tiab] OR "educational material*" [tiab] OR "Audiovisual Aids"[Mesh:NoExp] OR "audiovisual aid*" [tiab] OR "visual aid*" [tiab] OR "Multimedia" [Mesh] OR multimedia[tiab] OR "multi media" [tiab] OR multimedium[tiab] OR "Posters as Topic"[Mesh] OR poster[tiab] OR posters[tiab] OR "Telecommunications" [Mesh:NoExp] OR Telecommunication*[tiab] OR teleconferenc*[tiab] OR "Telefacsimile" [Mesh] OR "Telephone"

[Mesh] OR "Videoconferencing" [Mesh] OR Videoconferenc*[tiab] OR webcast*[tiab] OR podcast*[tiab] OR "Electronic Mail" [Mesh] OR "electronic mail*" [tiab] OR email*[tiab] OR "e mail*" [tiab] OR "electronic message*" [tiab] OR web[tiab] OR website*[tiab] OR webpage*[tiab] OR telephone*[tiab] OR phone[tiab] OR phones[tiab] OR cellphone*[tiab] OR smartphone*[tiab] OR "text messag*" [tiab] OR "texting*" [tiab] OR "short messag*" [tiab] OR "instant messag*" [tiab] OR "SMS"[tiab] OR app[tiab] OR apps[tiab] OR "web application" [tiab] OR "mobile application*" [tiab] OR Telefacsimile*[tiab] OR telefax[tiab] OR fax[tiab] OR facsimile[tiab] OR "Cell Phone Use" [Mesh] OR "Literacy" [Mesh] OR "Literacy" [tiab] OR "letter learning" [tiab] OR "illiteracy" [tiab] OR analphabetism[tiab] OR "Computer Literacy" [Mesh] OR "Information Literacy" [Mesh] OR "Access to Information" [Mesh:NoExp] OR "access to info*" [tiab] OR "freedom of info*" [tiab] OR "Internet Access"[Mesh] OR "internet access" [tiab] OR "Internet Use" [Mesh] OR "internet us*" [tiab] OR "Communication Barriers" [Mesh] OR "communication barrier*" [tiab] OR "communication problem*" [tiab] OR "digital divide" [tiab] OR "digital inequalit*" [tiab] OR "English proficiency" [tiab] OR "English abilit*" [tiab] OR "English level"[tiab] OR "level of English"[tiab] OR "information source*" [tiab] OR "information channel*" [tiab] OR "communication channel*" [tiab] OR "Language" [Mesh:NoExp] OR Language*[tiab] OR dialect*[tiab] OR "Language Arts" [Mesh] OR Multilingual*[tiab] OR bilingual*[tiab] OR polyglot*[tiab] OR polylingual*[tiab] OR "reading" [tiab] OR "writing" [tiab] OR "authorship" [tiab] OR "correspondence*" [tiab] OR "letter" [tiab] OR "letters"[tiab] OR "handwrit*"[tiab] OR "medical writ*" [tiab] OR "Verbal Behavior" [Mesh] OR "public speaking"[tiab] OR "speech*" [tiab] OR "easy read*" [tiab] OR subtitl*[tiab] OR "Manual Communication" [Mesh] OR "manual communication*" [tiab] OR "lipreading*" [tiab] OR "lip reading*"[tiab] OR "finger spelling" [tiab] OR ("deaf"[tiab] AND "interpret*"[tiab]) OR "augmentative communication*" [tiab] OR "alternative communication*" [tiab] OR "manual communication*" [tiab] OR "total communication*" [tiab] OR "braille"[tiab] OR "ideography"[tiab] OR "pidgin*" [tiab] OR "story tell*" [tiab] OR "communication format*"[tiab] OR "communication tool*" [tiab] OR "presentation format*" [tiab] OR "Data Display" [Mesh:NoExp] OR "data display*" [tiab] OR "data processing"[tiab] OR "information processing" [tiab] OR "information display*" [tiab] OR "display format*" [tiab] OR "Computer Graphics" [Mesh:NoExp] OR "graphical display*" [tiab] OR "graphical presentation" [tiab] OR "graphical representation" [tiab] OR "graphical format*" [tiab] OR "visual display*" [tiab] OR "visual presentation" [tiab] OR "visual representation"[tiab] OR "visual format*" [tiab] OR "layout"[tiab] OR "lay out" [tiab] OR "design feature*" [tiab] OR "graphical feature*" [tiab] OR "visual feature*" [tiab] OR "graphics" [tiab] OR "graphic" [tiab] OR "pictorial" [tiab] OR illustration*[tiab] OR "numerical display*" [tiab] OR "numerical presentation" [tiab] OR "numerical representation" [tiab] OR animation*[tiab] OR cartoon*[tiab] OR "iconicity" [tiab] OR "frequency format" [tiab] OR "message format*" [tiab] OR "design strateg*" [tiab] OR "Color" [Mesh] OR "color"[tiab] OR "colors" [tiab] OR "colorful*" [tiab] OR "colored"[tiab] OR "colour*" [tiab] OR "Data Visualization" [Mesh] OR "data visual*" [tiab] OR visualization*[tiab] OR visualisation*[tiab] OR Icon[tiab] OR icons[tiab] OR pictograph*[tiab] OR symbol*[tiab] OR "digital format*" [tiab] OR "ethnic targeting"[tiab] OR "racial targeting" [tiab] OR "perceived risk*"[tiab] OR "risk perception" [tiab] OR "message style*" [tiab]

Concept 4: Study design

"Clinical Study" [Publication Type] OR "clinical stud*"[tiab] OR "clinical comparison" [tiab] OR trial[tiab] OR "intervention stud*" [tiab] OR "interventional stud*" [tiab] OR RCT[tiab] OR RCTs[tiab] OR "observational stud*" [tiab] OR "observation stud*" [tiab] OR "Comparative Study" [Publication Type] OR "intermethod comparison"[tiab] OR "method comparison" [tiab] OR "methods comparison"[tiab] OR "comparative" [tiab] OR "controlled stud*" [tiab] OR "parallel group*" [tiab] OR "control group*" [tiab] OR "between group*" [tiab] OR "matched group*" [tiab] OR "group comparison" [tiab] OR nonrandom*[tiab] OR "non random*" [tiab] OR "Evaluation Study" [Publication Type] OR "evaluation stud*" [tiab] OR "program evaluation" [tiab] OR "programme evaluation" [tiab] OR "program acceptability" [tiab] OR "program appropriateness" [tiab] OR "program cost effectiveness" [tiab] OR "program effectiveness" [tiab] OR "program efficacy" [tiab] OR "program feasibility" [tiab] OR "program impact" [tiab] OR "program sustainability" [tiab] OR "programme acceptability" [tiab] OR "programme appropriateness" [tiab] OR "programme cost effectiveness" [tiab] OR "programme effectiveness"[tiab] OR "programme efficacy" [tiab] OR "programme feasibility" [tiab] OR "programme impact" [tiab] OR "programme sustainability" [tiab] OR "Meta-Analysis" [Publication Type] OR "meta analys*" [tiab] OR metaanalys*[tiab] OR "Systematic Review" [Publication Type] OR "systematic review" [tiab] OR "review" [ti] OR "Review" [Publication Type] OR "Controlled Before-After Studies" [Mesh] OR "before after"[tiab] OR "before and after"[tiab] OR "CBA stud*" [tiab] OR "panel stud*" [tiab] OR "prevention stud*" [tiab] OR "preventive

Appendix B. Tables A1 and A2

Table A1. Outcome of the assessment of the quality of the relevant studies in phase 1.

Study	Valid Study Design	Sound Methodology	Conclusion	Remarks
1. Kwok et al. (2021) [62]	N	N	Excluded	Wrong study design and topic
2. King and Lazard (2020) [63]	N	N	Excluded	Wrong study design
3. Bora et al. (2018) [64]	N	N	Excluded	Wrong study design
4. Choong et al. (2021) [65]	N	N	Excluded	Wrong study design and topic
5. Mishra and Dexter (2020) [66]	N	N	Excluded	Wrong study design and topic
6. Hillyer et al. (2021) [67]	N	N	Excluded	Wrong study design
7. Wilke et al. (2020) [68]	N	N	Excluded	Wrong study design and topic
8. Boonchutima et al. (2019) [69]	N	N	Excluded	Wrong study design
9. Okuhara et al. (2020) [57]	Y	Y	Included	
10. Dhawan et al. (2021) [70]	N	N	Excluded	Wrong study design and topic
11. Roess et al. (2017) [71]	N	N	Excluded	Wrong study design and topic
12. Ortega et al. (2020) [72]	N	N	Excluded	Wrong study design
13. O'Brien et al. (2018) [73]	N	N	Excluded	Wrong study design
14. Wieland et al. (2021) [74]	N	N	Excluded	Wrong study design
15. Piller et al. (2020) [30]	N	N	Excluded	Wrong study design
16. Edworthy et al. (2015) [75]	N	Y	Excluded	Wrong context
17. Basch et al. (2020) [37]	N	N	Excluded	Wrong study design
18. Merchant et al. (2021) [76]	N	N	Excluded	Wrong study design
19. Rousseau et al. (2015) [77]	N	N	Excluded	Wrong study design and population
20. Bekalu et al. (2018) [50]	Y	Y	Included	
21. Rahn et al. (2021) [78]	Y	Y	Excluded	Wrong focus
22. Viswanath et al. (2020) [79]	N	N	Excluded	Wrong study design
23. D'Souza et al. (2020) [80]	N	Y	Excluded	Wrong study design
24. Baseman et al., (2013) [55]	Y	Y	Included	
25. Baseman et al., (2015) [54]	Y	Y	Included	
26. Johnson et al. (2015) [53]	Y	Y	Included	

See reference list for the full bibliographical details of the appraised studies. Y = Yes; N = No.

Table A2. Outcome of the assessment of the quality of the relevant studies in phase 2.

Study	Valid Study Design	Sound Methodology	Conclusion	Remarks
1. Dennis et al. (2021) [59]	Y	Y	Included	
2. Mistree et al., (2021) [47]	Y	Y	Included	
3. Agley et al., (2021) [52]	Y	Y	Included	
4. Torres et al., (2021) [48]	Y	Y	Included	
5. Vandormael et al., (2021) [49]	Y	Y	Included	
6. Bahety et al., (2021) [56]	Y	Y	Included	
7. Chen et al., (2020) [29]	Y	Y	Included	
8. Alonzo and Popescu (2021) [81]	Y	Y	Excluded	Wrong focus
9. Beyari (2021) [82]	N	N	Excluded	Wrong study design
10. Chang et al. (2021) [83]	N	Y	Excluded	Wrong topic
11. Choi (2021) [84]	N	N	Excluded	Wrong topic
12. Choi and Choung (2021) [85]	N	N	Excluded	Wrong focus
13. Diniz et al., (2021) [86]	N	N	Excluded	Wrong topic
14. Gold et al., (2021) [87]	N	Y	Excluded	Wrong focus
15. El Baradei et al. (2021) [88]	N	N	Excluded	Wrong study design
16. Liu et al. (2021) [89]	N	N	Excluded	Wrong topic
17. Kwok et al. (2021) [62]	N	N	Excluded	Wrong study design
18. Khamis and Geng (2021) [90]	N	Y	Excluded	Wrong study design
19. Kenney et al. (2020) [91]	N	N	Excluded	Wrong focus
20. Goetz and Christiaans (2020) [92]	N	N	Excluded	Wrong topic
21. Geni et al. (2021) [93]	N	N	Excluded	Wrong study design
22. Emojong (2021) [94]	N	N	Excluded	Wrong topic

See reference list for the full bibliographical details of the appraised studies. Y = Yes; N = No.

Appendix C. Tables A3 to A15

Table A3. Summary sheet for Agley et al. (2021).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Agley et al., 2021, United States [52]	Experimental: randomized controlled trial (pilot test)	Unknown for receiver	Adult Americans (n = 100)	Participants were randomly assigned to five groups. Each group was shown a different infographic concerning "trust in science". Believability in the infographics and trust in science were measured (before and after viewing the infographics).	All infographics were perceived to be believable. All infographics lead to more trust, but only the infographic that pictured the scientist as a "normal human being" lead to significantly more trust.	The broader goal of this study is to gauge whether improvements in public trust in science and scientists can help combat the rapid spread of misinformation about COVID-19.

Table A4. Summary sheet for Bahety et al. (2021).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Bahety et al., 2021, India [56]	Experimental: randomized controlled trial	Unknown for receiver	Citizens of rural Bihar, India (n = 2283). Large part of the community (33% of women and 18% of men) is illiterate.	Participants were randomly assigned to one of 10 intervention groups and received text messages that differed in terms of content (private gain/loss versus public gain/loss) and timing (2× in the morning versus 1× in the morning and 1× in the evening). A control group did not receive any text messages.	Text messages reached the target audience well, but failed to have a significant effect on COVID-19 knowledge (such as the need to wash hands and social distancing). Neither timing nor content had a significant effect.	The study took place during a later stage of the pandemic; the text messages might not have had a significant effect as people already knew about the described measures.

Table A5. Summary sheet for Baseman et al. (2013).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Baseman et al., 2013, United States [55]	Experimental: randomized controlled trial	Public health authority	Healthcare professionals (HCPs)	HCPs were randomized in 4 groups to receive 3 to 4 public health messages via email, fax, or SMS, or to receive no messages (=control). Follow-up interviews were conducted 5 to 10 days after the message delivery date to check receipt of the message, recall of its content, and credibility of the message/source.	O1: Recall rates were inversely proportional to the mean number of messages received per week. O2: Every increase of one message per week resulted in a statistically significant 41.2% decrease in the odds of recalling the content of the study message ($p < 0.01$), 95% CI.	Sub-study of a larger RCT study to identify the most effective methods of communicating public health messages between public health agencies and HCPs/to evaluate and compare the effectiveness of mobile (SMS) and traditional (email, fax) communication strategies (REACH study: Rapid Emergency Alert Communication in Health).

Table A6. Summary sheet for Baseman et al. (2015).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Baseman et al., 2015, United States [54]	Experimental: randomized controlled trial	Public health authority	Healthcare professionals (HCPs)	Intervention: HCPs (physicians, nurses, pharmacists, and veterinarians) were randomly assigned to a group that received time-sensitive quarterly messages via email, fax, or SMS, or a no-message control group. Follow-up phone interviews elicited information about message receipt, topic recall, and credibility and trustworthiness of the message and source.	O1a. Correct recall among three intervention groups. E-mail: 290/646 (44.9%). Fax: 238/628 (37.9%). SMS: 243/651 (37.3%). Conclusion: Higher rate of recall of message for messages sent by e-mail than for those sent by fax or SMS. O1b. Correct recall among three intervention groups. E-mail: 277/573 (48.3%). Fax: 182/377 (48.3%). SMS: 95/244 (38.9%). Conclusion: The rates of recall for the e-mail and fax groups are similar (48.3%) and higher than for the SMS group (38.9%).	None

Table A7. Summary sheet for Bekalu et al. (2018).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Bekalu et al., 2018, United States [50]	Experimental	Public health authority (Red Cross) versus "unknown sender" (video clip from the movie Contagion)	American adults (n = 627)	Respondents are randomly assigned to view either a narrative (n = 322) or a non-narrative (n = 305) 4 min video clip (from the movie Contagion or from the American Red Cross YouTube channel) containing closely matched information about knowledge and preventive actions related to pandemic influenza. They completed pre- and post-viewing questions assessing their knowledge and perceived response efficacy related to the prevention of pandemic influenza.	O1: Knowledge of pandemic influenza (measured via 10 true or false questions, score on 10) Narrative group: M = 7.93, SD = 0.087. Non-narrative group: M = 8.33, SD = 0.089. Conclusion: Individuals who viewed the non-narrative version scored higher. O2: Response efficacy (measured via the mean of 6 seven-point Likert-type scale anchored at 1 = not at all effective to 7 = extremely effective) Narrative group: M = 6.04, SD = 0.056. Non-narrative group: M = 6.20, SD = 0.058. Conclusion: Individuals who viewed the non-narrative version rated the recommended responses to pandemic influenza as more effective.	Narrative video clip contains scenes from the movie Contagion (pictures corresponding to the facts in the Red Cross video clip). Non-narrative video clip is a compilation of Red Cross information movies. Conclusion: Didactic, non-narrative messages may be more effective than narrative messages to influence knowledge and perceptions during public health emergencies.

Table A8. Summary sheet for Chen et al. (2020).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Chen et al., 2021, China [58]	Experimental: randomized controlled trial	Visible source (=main source): verified (badge that confirms authenticity and trustworthiness of the source) versus non-verified. Receiver source: person who receives the message and may like or share it. Technological source: social media platform (public message on wall versus private message in private chat).	Students in China who use the social media platform Weibo	Respondents were randomly assigned to 12 intervention groups and read messages from a verified versus non-verified source (2) × a verified versus non-verified receiver source or no receiver source (3) × a different technological source (public message on post wall or private message in private chat box) (2).	Verified sources are more effective compared to non-verified sources. A non-verified visible source (or "main source") can be compensated by a verified receiver source.	A non-verified visible source (or "main source") can be compensated by a verified receiver source.

Table A9. Summary sheet for Dennis et al. (2021).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Dennis et al., 2021, United States [59]	Experimental: randomized controlled trial	Public health authority	Adult Americans (n = 292)	Intervention group received public health messages that were tailor-made, based on the religious or economic identity of the receiver. The control group received the same messages, but these were not tailor-made based on the identity of the receiver.	Tailor-made messages based on one's religious identity and economic values led to more motivation to follow COVID-19 regulations.	Public health messages were distributed via social media.

Table A10. Summary sheet for Johnson et al. (2015), part A.

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Johnson et al., 2015, United States [53]	Experimental: randomized controlled trial	Public health authority	American adults (n = 1408)	Intervention: 1408 respondents read Message 1 about the decision to monitor for 21 days, and answered questions about risk, knowledge, and trust. They then read Message 2 with 1 of 8 varied estimates of post-21-day symptoms, and answered the same questions again and personal preference for quarantine period.	Read Message 1 and Message 2. Everyone was informed about the possibility of post-21-day symptoms. Risk from asymptomatic person after 21 days: Higher rating: 46.7%. No change: 40.7%. Lower rating: 12.6%. Concern: Initial mean: 2.75. Final mean: 2.60. Experts agree: Higher rating: 44.3%. No change: 50.3%. Lower rating: 5.3%. Trust CDC: Initial mean: 3.28. Final mean: 3.18. Quarantine days: 25.48.	Message 1: People should be monitored after 21 days (assumption that there is no risk after 21 days). Message 2: A text on the risk of developing typical Ebola symptoms after 21 days. Remark: Even among those exposed to the supposedly disturbing news about post-21-day Ebola symptoms, most did not change their ratings at all, with (near) exceptions focused on perceived risk of an asymptomatic person at 21 days and belief in expert consensus about the proper quarantine period.

Table A11. Summary sheet for Johnson et al. (2015), part B.

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Johnson et al., 2015, United States [53]	Experimental: randomized controlled trial	Inoculation message: public health authority Threat message: (mock) news channel	American adults (n = 425)	Intervention: 425 new respondents answered baseline questions and either read or did not read an Inoculation Message. Both groups then read a Threat Message and answered the same questions again.	Read Inoculation Message and Threat Message. Asymptomatic risk: Higher rating: 43.8%. No change: 37.1%. Lower rating: 19.2%. Quarantine appropriate: Higher rating: 17.8%. No change: 78.6%. Lower rating: 3.6%. Quarantine days: Before: 23.50. After: 24.66. Conclusion: After reading the Threat Message: both Inoculation and Control groups presented higher ratings of personal and asymptomatic risks, greater concern about casual contact with such persons, lower trust in CDC, and belief that the quarantine period should be longer than 21 days. Controls had lower belief in experts' agreement on the proper quarantine period.	Message 1: People should be monitored after 21 days (assumption that there is no risk after 21 days). Message 2: A text on the risk of developing typical Ebola symptoms after 21 days. Remark: The majority among those exposed to the supposedly disturbing news about post-21-day symptoms did not change their ratings, with (near) exceptions focused on perceived risk of an a-symptomatic person at 21 days and belief in expert consensus about the proper quarantine period.

Table A12. Summary sheet for Mistree et al. (2021).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Mistree et al., 2021, India [47]	Experimental: randomized controlled trial	Public health authority	Students in urban India with a low income	Respondents were randomly assigned to intervention group 1 or 2 (IG1 or IG2) or a control group. IG1: watched a video of 10 min with facts on COVID-19. IG2: watched a video of 20 min with facts on COVID-19 and received further explanations of COVID-19 related concepts. Control group: did not watch any video.	Both videos contributed significantly to increased knowledge on COVID-19 and a more positive attitude toward COVID-19 measures. The effect of the longer video with a conceptual explanation (IG2) was significantly stronger.	None

Table A13. Summary sheet for Okuhara et al. (2020).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Okuhara et al., 2020, Japan [57]	Experimental: randomized controlled trial	A governor, a public health expert, a physician, a patient, and a resident of an outbreak area	1980 men and women aged 18–69 years without (mental) illnesses or disabilities	Intervention: One of five intervention messages from a governor, a public health expert, a physician, a patient, or a resident of an outbreak area, encouraging the reader to stay at home. Control: Message about bruxism from the website of the Ministry of Health, Labour, and Welfare	The message from a physician that conveyed the crisis of overwhelmed hospitals and consequent risk of people being unable to receive treatment increased the intent to stay at home the most.	Health professionals and media operatives may be able to encourage people to stay at home by disseminating the physicians' messages through media and the internet.

Table A14. Summary sheet for Torres et al. (2021).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Torres et al., 2021, United States [48]	Experimental: randomized controlled trial	A physician (with Black versus White skin colour) versus no physician	Adult Americans (divided into two groups based on their own perception of skin colour) (n = 20,460)	Respondents were randomly assigned to 1 of 3 groups and watched videos on COVID-19: Intervention group 1: watched videos of a physician with White skin colour. Group 2: watched videos of a physician with Black skin colour. Control group: watched videos with no physician speaking.	Message from physician leads to greater knowledge of COVID-19 and a greater readiness to follow regulations. Skin colour does not have an effect.	Conclusion: physicians are reliable senders of crisis communication; it is not necessary to tailor video messages based on skin colour.

Table A15. Summary sheet for Vandormael et al. (2021).

Author, Year, Country	Study Design	Sender	Receiver (Population)	Intervention, Control	Outcome	Remarks
Vandormael et al., 2021, United States, Mexico, United Kingdom, Germany, and Spain [49]	Experimental: randomized controlled trial	Public health officer	Online participants from the United States, Mexico, United Kingdom, Germany, and Spain; 18 to 59 years of age (n = 15,163)	Intervention group: watched the CoVideo, a wordless, animated social media video with information on the spread of COVID-19. Control group 1: watched a placebo video. Control group 2: did not watch any video.	Knowledge on COVID-19 was higher in the intervention group as compared to both control groups.	The videos were spread on social media.

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